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Cast Iron Losing Ground

Enamelling is a very important factor in the selling of iron castings to the public, as it converts a drab-looking material into one of pleasing aspect. Commercially, two materials are handled on a large scale, cast iron and steel sheet merging into thinnish steel plates. In many designs of commercial productions in this country, both materials are incorporated, though some are wholly of the one or the other. Mr. Bernard B. Kent, who has just returned from the United States, has informed us that steel sheet and pressings are rapidly replacing cast iron, and that in the mass-production plants Saturday morning is probably reserved for cast-iron components. In the case of gas cookers, this would be the burners. Now if this is an authoritative report, it must be related to the relative constancy of behaviour of the two materials under mass-production conditions. In favour of cast iron is the fact that dimensional accuracy can be held indefinitely, whereas with steel pressings there is a progressive deterioration with the continual operation of the die. On the other hand, there is less likelihood of variations in chemical composition and physical properties in steel pressings than in iron castings. Yet surely, using all the means of control available to the ironfounders to-day, a truly standardised casting for processing by the vitreous enamelling department should be easily possible of realisation.

One of the factories visited during the holding of the recent conference of the Institute of Vitreous Enamellers was the works of the Parkinson Stove Company, Limited, with which concern the Institute's president, Mr. R. J. Rogers, is associated. Hereat, there were ample facilities to see the two materials being processed side by side, under the most modern conditions. Yet the latest plant to be installed—a continuous vitreous enamelling furnace—appears to us to be pre-eminently suited for handling sheet stock.

The Birmingham meeting was essentially successful; the vitreous enamellers are obviously conscious of their place in the modern industrial setup, yet they are also well aware of the difficulties which beset them as a comparatively small industry. They see the publicity which is given to light alloys, stainless steel and plastics, and are genuinely apprehensive of the repercussions, whilst being supremely cognisant that they have a material which is superior for many, if not most, applications. Their chief enemy is to be found in their own ranks, in pre-war days, possibly amongst imported material, where the enamel was thicker than the steel it embellished.

There are odd jobs made as iron castings to be enamelled, and the situation at the moment is not too satisfactory. The jobbing vitreous enameller, like the jobbing foundryman, will not be beaten, even if he loses money. This is all wrong, and we strongly advise that this class of firm should send to every ironfounder customer, printed matter covering the question of design and composition in relation to vitreous enamelling. As this laudable craze for colouring industrial plant develops, the greater will be the demand for the use of vitreous enamelling surfaces, and with this comes the real necessity of teaching the foundryman, and through him the engineer, how to embody vitreous enamelling essentially in design.

A fund is being raised for research, and we suggest that there is an equally urgent necessity for a still larger sum to be spent on general and technical publicity. The prospects are as brilliant as the finishes the vitreous enamellers produce, but they are dimmed by the fog of ignorance amongst the *hoi polloi*, and the dispersion of this fog will cost money.

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TINNED PISTON RINGS

A Paper presented by Mr. D. M. Smith, of the McQuay-Norris Manufacturing Company, to the Western Michigan section of the S.A.E., gives much information on current American practice connected with piston rings. Mr. Smith deals with a wide variety of internal combustion engines including those in private cars, lorries, tanks, ships and aeroplanes, and makes recommendations as to the most suitable materials, ring-shapes and surface treatments.

What he would like to have is a piston ring material of maximum strength and elasticity which would "become immediately compatible" with the cylinder wall and wear forever. Steel is not a good material, though it is strong and elastic it does not have the wearing qualities. Grey iron, though less strong, has superior wearing qualities, and so far nothing better has been found. Indeed grey iron has been improved immeasurably in recent years.

Surfacing is stated to have been of the greatest value. The Author has tried out tin plating, cadmium, silver, nickel, copper, all plates of the softer variety, chrome, and many chemical surface treatments.

Tin plating has been used extensively in war industry. Its protection to the ring and cylinder surfaces during the run-in period is truly remarkable. Remember, it seals, it lubricates, and it protects against corrosion, scuffing, and scoring; and while its melting point is quite low, its presence is still found after many thousands of miles of road travel, or many hundreds of hours in the air; and if and when it is all worn off or gone, there is no loss of dimension. The basis measurements still remain. Tin, electrolytically deposited on piston rings, has been used in most aircraft engines in this country (U.S.A.) and in many of them abroad. It is used on piston rings in other types of engines, and its use is increasing because piston rings surfaced with an electrolytically deposited tin (Altinising*): (1) Seal immediately; (2 have less danger of scuffing and rapid wear; (3) resist acid corrosion, and (4) have less friction, allowing the rings to be more active in the groove.

None of the other softer materials have proved so far to be any better than tin. Chemically treated surfaces are valuable. They function by wearing away or abrading. They are resistant to corrosion. They do generally lose dimension and generally have no lubricating qualities.

Tin or Chromium

Chrome plating is highly recommended for the ring in the top groove where temperature is highest and abrasives are more concentrated. It is a poor seating material and is "incompatible" with chrome-plated cylinders and with certain steel cylinders. Preseating by honing or lapping or by very carefully controlled etching is recommended. If this stage is achieved successfully then chrome-surfaced rings will outlast

(*Continued at foot of next column.*)

*Altinising involves deposition of 0.0003 in. of tin from the alkaline stannate bath.

TURF CHARCOAL FOR CUPOLA MELTING

In 1941 the government of the Irish Free State set up an Emergency Scientific Research Bureau to advise on special problems relating to industrial processes and the use of substitute materials, and on the use of native and other materials to meet deficiencies caused by the restriction of imported raw materials and commodities.

The section of the Bureau's Report, which has just been issued, dealing with iron and steel, gives details of a number of investigations undertaken as a result of shortage of imports, and amongst these is one on the use of turf charcoal for cupola melting. At the time the Turraun plant had not begun production and the charcoal used was made by carbonisation of Mayo turf in vertical retorts at the Dublin Gas Works. It was very light and friable and contained 10.8 per cent. moisture with 5.9 per cent. volatiles, 4.9 per cent. ash, and a calorific value of 13,460 B.Th.U. per pound (anhydrous). Because of the low mechanical strength of the charcoal, attempts were made to start with a coke bed. but this failed because the coke failed to maintain a sufficient temperature and the iron solidified in the well.

Peat charcoal on account of its very high reactivity, ignites and burns much more rapidly than coke, and a cupola burning charcoal works much faster than on coke. The charcoal should be screened before use, in the small cupolas (13 and 16 in. diameter) used for these tests three to four inch material was used for the bed, and 1½ to 2½ in. for the melting charges. To avoid excessive breakage of the charcoal, the charge iron should be broken into lighter pieces than usual.

In the course of the experiments, iron was melted and cast with an iron-fuel ratio of as high as 10 : 1. The volume of air required per pound of fuel, 120 to 130 cub. ft., is substantially the same as with coke, but it would seem desirable to increase the size of the tuyere nozzles so as to reduce the blast velocity. These experiments were made with charcoal from hand-won turf, and it is clear that the denser and stronger charcoal made from machine-won turf would be a better foundry fuel.

In the course of the cupola experiments attempts were made to use a half-charred material containing 50 per cent. volatiles, resulting from early kiln charcoal-burning trials, Lullymore briquettes, and machine-won turf without success.

(*Continued from previous column.*)

others many times over, and life between overhauls may be increased up to tenfold. In many cases tin plating has been superimposed on chrome-plating to improve bedding down and friction qualities, and chrome-plate working on a tinplated surface is a most satisfactory combination.

The Paper also makes recommendations on the shapes and arrangement of piston rings for different types of engines and gives notes on the methods of carrying out various surfacing treatments.

GASEOUS ANNEALING OF WHITEHEART MALLEABLE CASTINGS

Industrial-scale results of a new short-cycle process

By P. F. HANCOCK, B.A.*

It has long been recognised that the present methods of annealing malleable castings, by packing them in ore in heavy cans, is completely out of harmony with modern concepts of efficiency. There has been little or no change in the procedure since it was first originated, and otherwise modern foundries have still to tolerate obsolete and inefficient methods in the annealing department.

The radically new process for annealing whiteheart castings described in this article makes it possible entirely to eliminate cans and iron ore, and to reduce to a matter of 20 to 30 hrs. a process previously requiring several days. Overall operating costs are reduced to a fraction of those of the older methods and working conditions are compatible with the practice of the most modern heat-treatment plant. The process is fully covered by a number of British and foreign patents.

Introduction and Early Development

The outstanding advantages of the gaseous method of annealing whiteheart malleable castings first led to its consideration many years ago and from time to time possible processes for its application have been suggested. None, however, had ever reached a sufficiently practical stage to enable it to be adopted widely on an industrial scale until the advent of the process to be described in this article. The basic idea of this present process arose partly from a knowledge of the annealing problems of the whiteheart malleable industry and partly from experience of the application of controlled furnace atmospheres to other heat-treatment processes. In particular, similarity of the problems to those encountered in the gaseous carburising process for case-hardening of steel components, which was also in course of development and has since become well established, was obvious; so, also, was the advantage to be gained in both processes by dispensing with boxes and solid packing materials, with consequent improvement in thermal efficiency, controllability and operating conditions.

Development work, which was initiated in this country in 1940, was directed, in the first place, to obtaining fundamental information on such factors as times and temperatures for annealing various sections, the effect of composition of castings and atmosphere, the results of various rates of cooling from the annealing temperature, and so on. For these first experiments, a small gas-tight electric batch furnace was used, as illustrated in Fig. 1. Decarburising atmospheres, prepared by combustion of charcoal or of coal gas were employed, the characteristics of which, in respect to oxidising and decarburising tendency, were already well known from their use in the heat-treatment of steel.

The results of this work showed great promise and indicated that average-section castings could be annealed satisfactorily in periods of from 15 to 30 hrs. at 1,050 deg. C., this being chosen as the highest practicable working temperature for industrial operation. It was possible, in the light of these results, to visualise a full-scale process on these lines, using large horizontal batch type electric or radiant-tube, gas-fired furnaces and externally prepared decarburising atmospheres derived from coal gas. Some calculations, however, of the quantity of coal gas needed to decarburise a charge of several tons of castings indicated that this would form a large item in the annealing cost and that it was highly desirable to find a cheaper source of decarburising gas.

Atmosphere Regeneration

A possible solution of the problem appeared to be as follows:—When a decarburising atmosphere is passed over a charge of castings, it changes the composition as a result of the decarburising reaction and the spent gas emerging from the furnace is relatively higher in carbon monoxide content and lower in carbon dioxide. If this spent atmosphere were collected and burnt with a controlled amount of air, sufficient to reconvert the excess carbon monoxide back to dioxide, its decarburising properties would be restored and it could be returned to the furnace for further use. In other words, the same gas could be used over and over again and the only need for externally generated atmosphere would be for initial purging of the furnace and to make up losses of atmosphere gas in the furnace and circulating system. The latter loss would be dependent on the particular design of furnace adopted, but in the worst case, would be only a fraction of the volume required if no recirculation were employed.

There were practical difficulties in trying out this atmosphere recirculation and regeneration scheme on the small scale on which the preliminary experiments were done and a practical trial had to await the installation of a larger furnace. The opportunity for this came, some time later, when a large malleable foundry, making tank track links, became interested in the gaseous process. After considerable experiment, directed to applying the process to this particular product, particularly to combining the annealing treatment with a quenching and tempering operation to produce

* Chief metallurgist, Birlec, Limited.

Gaseous Annealing of Whiteheart

the required sorbitic structure, a pilot plant was installed at this foundry towards the end of 1942. This furnace was a standard, horizontal, batch type electric furnace with a hearth approximately 7 ft. long by 4 ft. wide, and equipped with a charging machine. It was provided with an external atmosphere generator working from coal gas, and a recirculation system by which the spent atmosphere was withdrawn from the front of the furnace and reinserted, together with a controlled addition of air, into the back of the furnace.

Useful design and operating experience was obtained from this furnace, which will not be recounted in detail, since much of it was concerned with the heat-treated malleable product which is of secondary interest only to most of the industry. The gas recirculating system, however, proved itself completely, and it was possible to cut the gas consumption to one third of that otherwise required for a charge of this size. Moreover, the amount of make-up to the recirculation system was found to be governed entirely by the loss of gas around the door of the furnace, which had no special arrangement for gas-tight sealing. It was realised that with a somewhat different design of furnace, arranged for more thorough sealing, an external gas generator could be dispensed with entirely and the whole of the atmosphere requirements met by the reaction products of air with the carbon content of the castings.

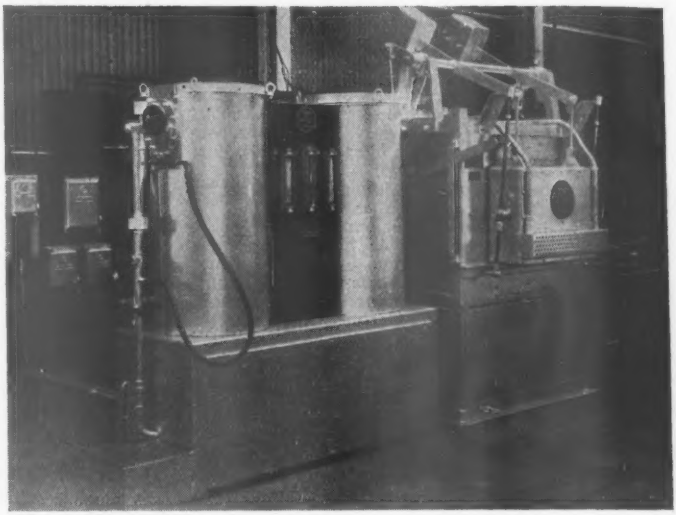

FIG. 1.—BATCH TYPE FURNACE AND ATMOSPHERE GENERATOR FOR INITIAL EXPERIMENTS IN GASEOUS ANNEALING.

FIG. 2.—GENERAL VIEW OF ELEVATOR TYPE FURNACE WITH CHARGED BOGIE.

In addition to work on heat-treated link castings, a number of charges of straight annealing were put through this furnace with satisfactory results. From this experience, sufficient data were available to proceed with design on a full-scale furnace. The reasons which led to the particular design of batch furnace which has been adopted and the relative merits of batch and continuous furnaces, will be discussed in detail later in this article.

Atmospheres for Industrial-scale Operation

The fundamental process in whiteheart annealing is, of course,

decarburisation—that is, oxidation of the carbon content of the castings without simultaneous oxidation of the iron. The chemical conditions under which decarburisation occurs are well known and they may be simply stated as (1) the presence of carbon monoxide and carbon dioxide, and/or (2) the presence of hydrogen and water vapour in proportions dependent upon the temperature. For carbon monoxide/carbon dioxide mixture, this proportion should lie between about 3:1 and 10:1 for the temperature range in which whiteheart annealing is carried out, namely 950 to 1,050 deg. C. For hydrogen/water vapour mixtures, the proportions lie between about 1½:1 and 5:1. More or less of inert gas such as nitrogen may also be present, of course.

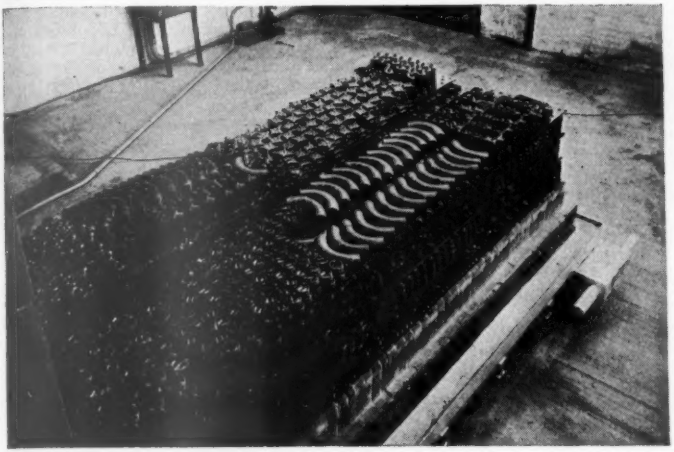

FIG. 3.—BOGIE OF ELEVATOR FURNACE LOADED WITH APPROXIMATELY 5 TONS OF PIPE FITTINGS.

Now when a gas mixture of this type, containing, say, carbon monoxide and carbon dioxide, is brought into contact with the hot castings, decarburisation proceeds by reaction of the carbon dioxide with the carbon in the castings with formation of carbon monoxide:—

$$CO_2 + C = 2\,CO.$$

The carbon monoxide content thereby rises until, in a short time, if the atmosphere is stagnant, the reaction stops due to all the available carbon dioxide being used up. To keep the decarburisation going at maximum speed, fresh supplies of carbon dioxide-containing atmosphere must be fed continually to the castings. This may be achieved in one of two ways, either a regular flow of gas of suitable composition may be passed through the furnace from an external gas generator and thence blown to waste; alternatively, the spent gas, after passing over the castings, may be regenerated and recirculated. The regeneration—*i.e.*, the reconversion of carbon monoxide back to dioxide ($CO + O = CO_2$)—may be effected by reacting it with oxygen, air, steam or other oxidation gas.

For large-scale operation, as has been indicated earlier, the method of recirculation is most desirable from the economic point of view. The following rough figures for cost of the decarburising atmosphere per ton of castings annealed, illustrate the point.

These figures show clearly that an air- or steam-regenerated system is the obvious choice and, of the two, air is the simpler to apply. It has the further advantage that, in the chemical reactions involved with air,

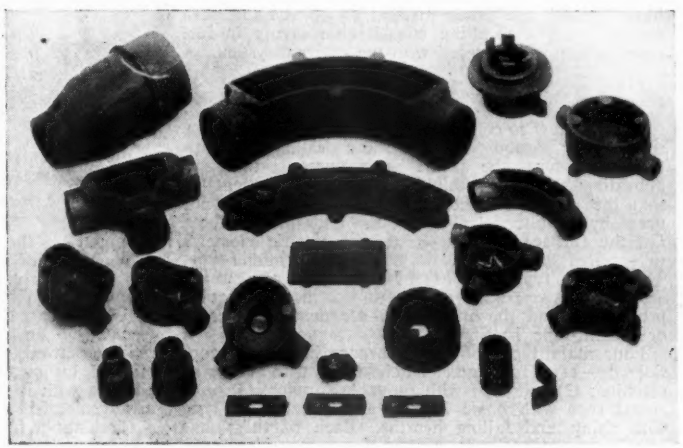

FIG. 4.—SAMPLE CASTINGS ANNEALED BY THE GASEOUS PROCESS. CERTAIN ITEMS SHOWN TESTED BY DE-FORMATION.

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heat is given out, whereas with steam, heat is absorbed. This point may seem to be of academic interest only, but calculation shows that the difference is about 550,000 B.Th.U. per ton of castings annealed, which is equivalent to 10 or 15 per cent. of the total fuel requirements, and therefore by no means insignificant. There is also a certain amount of evidence that absence or low percentage only of hydrogen in the annealing atmosphere is advantageous with some types of malleable, and this again weighs the balance in favour of the use of air rather than steam.

Externally Generated Atmosphere :—	
(*a*) From coal gas	£2 15s.
(*b*) From charcoal	£4
(*c*) From coke	16s.
Recirculated Atmosphere :—	
(*a*) Regeneration by pure oxygen..	£1 5s.
(*b*) Regeneration by steam ..	1s.
(*c*) Regeneration by air	Nil

With regard to the recirculating system itself, this may be external to the furnace, *i.e.*, the spent atmosphere may be withdrawn from one end of the furnace and returned, by way of external ducts and a circulating fan, to the other end, where it is reinserted together with the correct addition of air. This method has the disadvantage that there is a considerable loss of heat from the external piping system and the preferable alternative is to have the circulation wholly internal. *i.e.*, by means of a fan and baffle system forming part of the furnace chamber. Recent developments in the construction of high-temperature fans have enabled the latter method to be adopted with success, with a resulting considerable saving in fuel consumption as compared with the external system.

Batch-type Furnaces

Turning now to consideration of the types of furnace suitable for gaseous annealing, and dealing first with the batch type, the prime requirement is that the annealing chamber should be relatively gas-tight so that the controlled decarburising atmosphere is not upset by fortuitous leakage of air and flue products, *i.e.*, the furnace must be heated by electric elements or gas-fired radiant tubes or it must be of muffle type. The latter type, due to the large size of furnace and the high operating temperature, is not a practical proposition and the alternatives are therefore electric or radiant-tube heating.

Four main types of batch furnace have been considered:—(1) Horizontal batch type with charging machine; (2) bell type with movable furnace; (3) horizontal type with bogie hearth, and (4) elevator type with rising and falling hearths. Each of these has certain advantages, but various design considerations, such as the ease of sealing against leakage coupled with convenience of operation, have led, in the first place, to the adoption of the elevator type, electrically-heated, and this will, therefore, be described in some detail.

Design of Furnace

The furnace proper, which is rated at 300 kW maximum and has loading space dimensions 14 ft. long by 5 ft. wide by 2 ft. high, is mounted above floor level on a structural steel framework. It consists of a rectangular gas-tight steel casing, completely closed on the four sides and roof and lined with insulating and semi-refractory bricks, the heating elements being

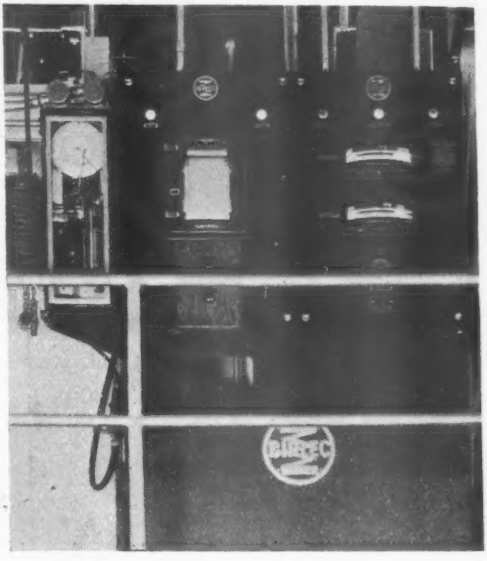

FIG. 5.—TEMPERATURE CONTROL AND RECORDING INSTRUMENTS AND AUTOMATIC GAS COMPOSITION CONTROLLER.

mounted on the side walls and roof. The hearth is in the form of a removable bogie (two of which are supplied with each furnace) which is loaded at floor level and then transferred, after loading, to a position under the furnace and elevated into the latter by an electrically- or hydraulically-operated hoist. Gas-tight sealing between the hearth and the furnace proper is effected by means of a skirt on the furnace which engages with a sand seal on the hearth. The general arrangement of such an installation is shown in Fig. 2.

Circulating fans are disposed in the roof of the furnace and the charge is loaded on the hearth on an open shelf structure, arranged to allow free circulation of the atmosphere over all parts of the charge. This

charge-carrying structure is made up from loose channel sections and plates and it has been found possible to use mild steel for its construction, thus avoiding the need for nickel-chromium alloy castings, the replacement of which would otherwise form a considerable item in the running costs. It may be noted that the only nickel-chromium alloy used in this furnace is for the heating elements and circulating fans.

It is, of course, undesirable to expose the annealed castings to air at the full annealing temperature, from the points of view both of physical properties and of surface finish. It is necessary, therefore, to cool the

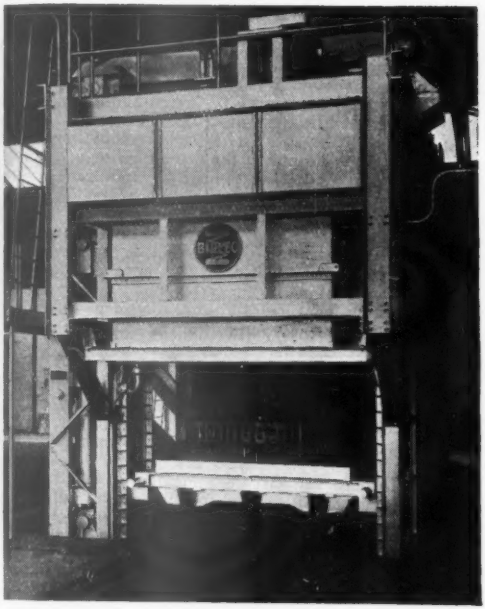

FIG. 6.—VIEW OF ELEVATOR FURNACE SHOWING BOGIE BEING LIFTED INTO POSITION.

annealed charge in the furnace to a temperature in the range of 550 to 600 deg. C. before discharging. With a well-insulated furnace, the time for natural cooling from 1,050 to, say, 600 deg. C., would be of the order of 50 hrs. or longer, so in order to effect the cooling of the charge and furnace in a reasonably short time, a forced cooling system is incorporated. During the heating and soaking period in the annealing cycle, the ducts between the furnace proper and the cooling system are closed by dampers. At the end of the soaking period, the dampers are opened and the cooling blowers started; hot atmosphere gas is withdrawn from the furnace chamber, passed over the cooling coils and returned to the furnace chamber again. By this means, the furnace and charge may be cooled to 600 deg. C. in a minimum time of about 3 hrs. If this rate of cooling be found too rapid for some types of casting, it may, of course, be reduced by suitable adjustment of the cooling system dampers.

Control of Atmosphere and Temperature

Atmosphere control is effected by the addition of air for decarburisation to the circulating system by means of a small blower with a control valve and flow meter. A CO_2 recorder is fitted and the addition of air is regulated to maintain the CO_2 between 5 and 8 per cent. For a 3-ton charge, the volume of air required at the beginning of the cycle is approximately 2,000 cub. ft. per hr., falling to about 150 cub. ft. per hr. at the end. If desired, the atmosphere control may be made fully automatic by means of electrical contacts on the CO_2 recorder operating a motorised valve on the air supply.

The temperature of the furnace is automatically controlled within a few degrees and excess-temperature safety devices are fitted to provide against any failure in the temperature control system. Here again, if desired, the whole cycle of heating, soaking and cooling periods may be made fully automatic by use of a programme-control instrument provided with suitable contacts to bring the cooling system into operation at the required point in the cycle.

Method of Operation

To obtain a clear picture of the method of operation of this furnace, the following outlines the sequence of events in annealing a charge. One bogie, with an annealed charge, has just been removed from the furnace at a temperature of 600 deg. C., and transferred to the unloading station. The second bogie, which has been loaded with castings while the first bogie was in the furnace, is now moved from the loading station to a position underneath the furnace and elevated into the latter by the hoist. The heat is switched on and the temperature control set to the annealing temperature. Heating up with a 3-ton charge takes about three hours, and during this heating up stage the atmosphere in the furnace is at first air. In the early stages, the oxygen of this air is absorbed by the castings, resulting in a thin film of oxide, nitrogen being left as the main constituent of the atmosphere. As the temperature rises, this oxide film is reduced by the carbon in the castings with formation of CO and CO_2 until, as full temperature is approached, the atmosphere consists mainly of nitrogen and CO. The atmosphere circulating fans and decarburising air supply are then turned on, the air supply being adjusted by hand or by automatic means to maintain the CO_2 content between 5 and 8 per cent. As annealing proceeds, the amount of air needed falls, and, if hand control of the air supply is used, adjustment is necessary every two hours or so. The excess atmosphere gas is allowed to blow to waste through a vent pipe.

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At the end of the soaking period, which will be between 16 and 35 hrs., depending upon the type of castings, the decarburising air supply is cut off, the vent pipe closed, the furnace heating elements switched off, and the forced cooling system brought into operation. When the temperature has fallen to approximately 550 to 600 deg. C., the bogie is lowered and transferred to the unloading station. Meanwhile, the second bogie, after cooling to room temperature, has been unloaded, transferred to the loading station, reloaded, and is now ready to transfer to the furnace for the next cycle.

The overall cycle per charge is thus between about 20 and 45 hrs., the latter being necessary only for heavier types of casting. The charge accommodated is from three to five tons, and the throughput per week of 168 hrs. is 15 to 20 tons, or somewhat higher for favourable loads.

Practical Operating Data

A furnace of the type described, illustrated in Fig. 2, has recently been installed at Walsall Conduits, Limited, West Bromwich. Fig. 3 shows a close-up of the bogie, loaded with conduit castings; typical examples of the latter, including some tested to destruction, are shown in Fig. 4. Fig. 5 illustrates the control panels, with temperature regulators and recorders at the right and the automatic CO_2 recorder and controller at the left.

The furnace is employed for the annealing of conduit fittings, casting sections varying between about $\frac{3}{32}$ in. and $\frac{1}{4}$ in. The maximum charge which has been annealed is 4½ to 5 tons net, the overall cycle found necessary for this weight of charge being 33 hrs., made up of four hrs. heating, 24 hrs. soaking and five hrs. cooling. The final carbon content on the $\frac{3}{32}$-in. to $\frac{1}{4}$-in. sections is 0.4 to 0.8 per cent. with excellent ductility.

It has been found preferable to work, usually, with a charge of approximately three tons net. With this charge weight, an overall cycle of 24 hrs. can be achieved, made up of three hrs. heating, 18 hrs. soaking and three hrs. cooling, with the same final carbon content. While the smaller charge results in a somewhat higher power consumption—*i.e.*, 1,000 to 1,100 kWh. per ton, as against 700 to 800 kWh. per ton on the 5-ton charge—this is probably more than counterbalanced by the convenience of the 24-hr. cycle from the point of view of operating schedule. The overall output per week is similar in both cases, namely, 18 to 22 tons. With regard to labour, about eight to 10 man-hours per ton are found to be needed for loading and unloading castings of this type on the bogies. When more experience has been acquired in operation of the furnace, it is expected that this figure may be considerably reduced.

Annealing of Blackheart

While this type of batch furnace has been developed primarily for annealing of whiteheart castings, it may be mentioned, in passing, that it is equally suitable for blackheart annealing. The requirements, in the latter case, differ in two respects:—(*a*) A non-decarburising atmosphere is desirable; and (*b*) closer control of the cooling cycle is needed. The former requirement may be met by dispensing with the decarburising air supply, and the latter by the addition of a programme-control instrument, operating in conjunction with the forced cooling system, to give the required slow cooling through the critical range. On blackheart, a somewhat larger charge of five to six tons could be accommodated in the furnace, since there is no necessity to leave space for circulation of the atmosphere. The overall cycle might be expected to range between 40 and 75 hrs. according to the composition of the iron.

Continuous Furnaces

No continuous furnace for gaseous annealing of whiteheart castings has yet been installed in this country; continuous furnaces for fairly similar service have, however, been built and have given satisfactory service for many years, and the general lines along which a furnace for gaseous annealing would be built are well defined. Furnaces for continuous annealing of blackheart castings in neutral atmosphere have been in operation in America for some years and a furnace for whiteheart annealing would be essentially similar, except for the different temperature cycle and the introduction of a controlled decarburising atmosphere and circulation system.

TABLE I.—*Annealing Cycle and Power Consumption for Various Loads in Batch-type Furnace.*

Heat No.	Load.	Heating Time.	Soaking Time.	Cooling Time.	Total Cycle.	Power consumption kWh.	Consumption kWh per ton.
	(Tons.)	(Hrs.)	(Hrs.)	(Hrs.)	(Hrs.)		
1	4.17	4	24	5	33	2,960	709
2	3.91	4	21	4	29	2,831	724
3	3.77	4½	30	4½	39	3,068	818
4	3.31	4½	24	4	32½	3,070	930
5	2.16	3	18	3	24	2,383	1,103
6	2.55	3	18	3¼	24¼	2,493	978

Of the various furnace types available, *viz*, pusher, roller hearth, rotary hearth, walking beam, the pusher type is probably most satisfactory. In this type, the furnace is in the form of a tunnel, through which trays of castings are pushed by means of a mechanical or hydraulic mechanism at the loading end. Heat-resisting roller-rails extend from end to end, on which the trays ride and the ends of the tunnel are closed by double-door lock-chambers for retention of the controlled atmosphere. The operation of these doors is interlocked with the pusher movement to ensure the correct sequence of operation. Heating may be by electric elements or by gas-fired radiant tubes above and below the roller track, and for temperature control, the furnace is divided into a number of separately controlled zones.

The decarburising atmosphere may be obtained, exactly as in the batch type furnace, by injection of air in controlled quantities through multiple inlets disposed along the length of the furnace and circulating fans would be fitted in the neighbourhood of the inlets to promote the required circulation through the trays of castings. For initial purging, trays loaded with scrap castings, or with charcoal or other combustible material would be pushed through the furnace. Unlike the batch furnace, once the atmosphere conditions are stabilised the amount of air required for decarburisation remains constant, provided there is a steady throughput of castings, and consequently, automatic control of the atmosphere is not necessary.

Slow-cooling Zone

A short, insulated, slow-cooling zone would be incorporated at the end of the soaking zone of the furnace, to give a suitable rate of cooling through the critical range, followed by a water-cooled zone to bring the castings down quickly to a convenient temperature for discharge. A furnace of this kind may readily be made recuperative, by having two parallel roller tracks, with the trays pushed in opposite directions on the two tracks, so that the incoming material is preheated by the outgoing.

Advantages of Continuous and Batch-type Furnaces

Of the two types of furnace, the batch is lower in first cost, particularly for smaller outputs. In running costs, however, the large, continuous furnace has a small advantage, provided that it is kept running at full output. The power or fuel consumption is lower, since the furnace has not to be heated and cooled with each charge, as has the batch furnace; moreover, the continuous furnace may be of the recuperative type, thus further reducing heating costs. The labour requirements for a continuous furnace are also somewhat less; against these advantages, the maintenance costs of the continuous furnace are rather higher, since it necessarily incorporates a larger amount of nickel-chromium alloy in its construction, the replacement of which must be reckoned in the running costs.

Insufficient data are yet available to give firm figures for running costs, but the following tentative figures for costs per ton are compiled from present experience, coupled with estimates for life of furnace parts from experience with other types of furnace on comparable service. The comparison is between an electric batch type furnace of output 20 tons per week and an electric non-recuperative, continuous furnace of output 40 tons per week. Power costs are assumed to be 0.75d. per unit; maintenance costs are based on replacement of the heating elements every two years, the mild steel carrier plates and supports in the batch furnace every three months and the heat-resisting alloy trays, rails and other parts in the continuous furnace every year. Labour requirements are assumed on the batch furnace to be one supervisor for an installation of two furnaces, together with three labourers per furnace for loading and unloading; on the continuous furnace, one supervisor and two labourers have been allowed for on one furnace.

	Batch furnace, 20 tons per week.	*Continuous furnace*, 40 tons per week.
	£ s. d.	£ s. d.
Power	3 9 0	2 4 0
Water	0 4 0	0 3 0
Maintenance	0 14 0	1 15 0
Labour	1 3 0	0 11 0
Total	5 10 0	4 13 0

Taking into account the higher first cost and consequent higher depreciation and interest charges, the above figures indicate that the advantage lies very slightly with the continuous furnace. This advantage would increase by some 10 to 15s. per ton if a recuperative design were used; but it must be remembered that this advantage will be lost if the continuous furnace is run at less than full capacity, *e.g.*, by frequent changing of the annealing cycle.

Summarising, one may say that the continuous furnace is suitable for large outputs of similar-section castings, but for smaller or varied outputs, the batch furnace is more flexible and is to be preferred.

Advantages of Gaseous Annealing

Many of the advantages of gaseous annealing as compared with pack annealing will have become apparent from what has already been said, but they may be briefly summarised as follows:—

(1) Elimination of heavy cans and ore, resulting in quicker heating and improved thermal efficiency.

(2) Reduction in labour requirements.

(3) A shorter cycle and quicker throughput, enabling short deliveries to be made.

(4) Reduced floor space for a given output.

(5) A considerable saving in overall operating costs resulting from these factors.

(*Continued overleaf, column* 2.)

SAND PRACTICE IN LANCASHIRE-YORKSHIRE REGION

STEELFOUNDERS' DISCUSSION

Information supplied to the Lancs and Yorks regional committee of the British Steel Founders' Association showed that there were very wide variations in the make-up and test properties of sand mixtures used successfully for making similar castings. This did not mean that it was very easy to make sound castings with a good finish, but rather emphasised the fact that the manipulation and treatment of the mixtures was very different in the various foundries. The hardness of ramming, for example, influenced the permeability of the surface layers of a mould and affected the stripping. The green and dry strengths were easily altered by variations in water content, and by adding coarse or fine materials to the mixture.

The properties of moulding sand mixtures were considerably modified during milling, and it was suggested that investigations should be carried out to find the methods of milling, including the milling time, which would put sands of particular types into the best condition for foundry use. Skin-drying of moulds was much cheaper than drying moulds completely, and saved fuel. It was suggested that many steelfoundries did not at present make the fullest use of this process and that its possibilities should be investigated in a practical way.

Methods of Treating Used Sand

There were very wide variations in the proportion of used sand reclaimed, and in the methods adopted for the reclamation. It was pointed out that reclaiming used sand saved the expense of sending it out as rubbish, and reduced the quantity of new sand to be bought. The best method of treating used sand to make it good enough to replace a large proportion of new sand must be worked out in each individual foundry, but it appeared evident that much more sand could be reclaimed than at present. Sand reclamation should not be confused with the use of old sand for backing purposes, which was common to most foundries.

The cost per ton of the sand mixtures used varied considerably. These differences had been accentuated during the last few years owing to substantial increases in the cost of individual sands. Several Papers had recently been published describing new sources of British foundry materials and every foundry should consider whether alternative materials were available at a lower price. In some cases their use might mean a modification in foundry practice but this should not deter foundry managers from making experimental changes. The moulding materials used should be such as would give easy fettling, and any modification in materials or methods of moulding which would reduce fettling times was worth while.

Most foundries used mould or core paints. During the last few years, a number of non-siliceous paints had been developed and others were under investiga-

(*Continued at foot of next column.*)

GASEOUS ANNEALING OF WHITEHEART

(*Continued from previous page.*)

(6) Improved cleanliness and better working conditions generally, a factor which is becoming of increasing importance in industry to-day.

(7) An improved quality and uniformity of product. The surface finish is excellent, requiring no after-cleaning operation and the possibility of peeling is entirely eliminated. Ductility, machinability and freedom from distortion may be maintained as good as, or better, than on the conventionally annealed product.

In conclusion, it may be claimed that the development of the gaseous annealing process to the stage of successful industrial application marks a step forward of revolutionary importance for the whiteheart industry. The difficulties associated with the older annealing method, which have hitherto been regarded as inevitable though serious handicaps to the expansion of the malleable industry, are completely abolished by the gaseous process. As a result, a new conception of whiteheart production is opened up which may radically improve the status of the industry from both operational and marketing points of view.

GERMAN TECHNICAL REPORTS

The following reports, made by teams of experts who have visited Germany under the auspices of the British Intelligence Objectives Sub-committee and the Field Information Agency, Technical, are now available. They may be obtained from H.M. Stationery Office, York House, Kingsway, London, W.C.2. The post-free price is given between brackets.

B.I.O.S. 685—German ingot moulds for the casting of steel ingots (11s. 3d.); B.I.O.S. 789—Special steels. Notes on practice at Krupp A.G., Essen and Deutsche Edelstahlwerke A.G., Krefeld (5s. 2d.); B.I.O.S. 818—Notes on German iron and steel foundries, including centrifugal castings (3s. 8d.); B.I.O.S. 825—Notes on German steel-making practice (7s. 9d.); B.I.O.S. 829—German agricultural engineering industry (3s. 2d.); F.I.A.T. 798—Titanium metal produced by Degussa and Osram (1s. 1d.); F.I.A.T. 699—Magnesium Determinations in Aluminium (3s. 2d.).

(*Continued from previous column.*)

tion. It was emphasised that the technique of applying these paints was just as important as the materials from which they were made, and to obtain the best, results and methods of application should be carefully studied.

The steelfoundries in the region had very willingly supplied the information asked for, and were evidently prepared to collaborate in the co-operative research which would be of general benefit. The report under discussion was preliminary in nature, and showed that there was ample scope for investigations which would lead to improvements in steelfoundry practice throughout the industry.

INSTITUTE OF VITREOUS ENAMELLERS *Twelfth annual conference in Birmingham*

Following upon the chairman's address, printed last week, the members of the Institute of Vitreous Enamellers, assembled for the 12th annual congress, which was held at the Grand Hotel, Birmingham, heard Mr. J. W. Gardom, the retiring president, detail the proposed methods for reinforcing the technical and research interests of the Institute.

MR. J. W. GARDOM, reporting in his capacity as chairman of the technical committee, said there had been four meetings. At present there were four members appointed by the council to the committee. Their attendance had been excellent, the work they had done was excellent, but they had not been able to do all the work that he had hoped. Why was it? He felt that they had had far too many things under control technically. They had been attending far too many B.S.I. meetings, and things of that sort. But it had been necessary and the committee had put in a lot of time. Sub-committees had been formed, essentially with the object of bringing in younger and more widely-spread members throughout the Institute. Again, he did not feel that they had had quite the success in that direction that they expected. The younger members appeared to be rather tied up with other work. Perhaps, in some cases, the younger members were not allowed to get away to attend meetings and discussions. He suggested that while it was annoying to walk round the works and not find an assistant where they expected to find him, if he was away attending a meeting of these sub-committees he was doing good work for the industry and one's first duty was to the industry. A new sub-committee on welding had been appointed but it had not yet been possible to get it going. The council decided that it would be wise, if possible, to set up a research organisation in connection with the British Iron and Steel Research Association for the vitreous enamelling industry, and had been looking into the matter. Much of the work had been passed over to the technical committee for investigation. He did not think it would be right to enter into discussion on the matter, because he knew that many of them were divided in the way they looked at research. He was certain that research could not be bounded by the laboratory walls. A letter had been prepared by the council, which had been sent to every firm interested in the enamelling trade. It enumerated their reasons for thinking that research was necessary in the vitreous enamelling field, and explained how collaboration with other societies and research associations could be effected. It also put forward the B.S.I. ideas with regard to money; that it should be paid by industry as a percentage. Mention was made of the fact that the research sub-committee had given careful consideration to the amount necessary and considered that the minimum sum required was £6,000 a year. The letter would be going out shortly and on the response would depend what further steps the council would take. If they could raise the necessary money, they would go forward. If not, they would struggle on. They would not give in, but would find some other means. He hoped they would all give the matter thought, and that when the letter was received by their firms they would do their utmost to persuade the particular person who had to make the decision that it was a worthwhile job.

Closer Contact with America

He had also to report that they had a closer contact now with the American Ceramics Society than formerly, and it was agreed that they should do their utmost to contact other countries and their vitreous enamelling sections or associations. Alluding to the mode of election to the technical committee, Mr. Gardom said he was a bit of a reactionary on the council from time to time, but he did occasionally get his own way. He had suggested that their method of selecting four members from the council to be the technical committee was not quite so democratic as our democratic Government of to-day might wish. It savoured a little of the closed shop, perhaps. It had been agreed by the council that

[*Photo : H. J. Whitlock*

MR. R. J. ROGERS,
President of the Institute.

Institute of Vitreous Enamellers

in future the committee should consist of six members. The whole of the Institute would be asked for nominations for the technical committee, and they would not necessarily consist of council members. By this means they would be widening the field and giving the younger men an opportunity which was far more important to technical men, who did not want to listen to council deliberations on matters of administration, or non-technical or semi-technical subjects. This point would come before the next annual general meeting, as it had been quite impossible to bring it forward at the present meeting.

DISCUSSION

MR. S. H. RYDER, referring to the method of determining who was to serve on the technical committees to consider various problems, said he gathered that Mr. Gardom was not satisfied with the way members of the Institute were prepared to come forward and serve. A long time ago he (Mr. Ryder) filled in a form saying that he was prepared to serve, but he had heard nothing since. While he was not particularly anxious to spend a lot of time on the work he appreciated its importance to the industry.

MR. GARDOM, in reply, said that Mr. Ryder was one of the people who had applied and for whom they had not a job. Every member was asked to fill in a card saying what he suggested as suitable work for a sub-committee, and whether he was prepared, in the event of a sub-committee being formed, to sit on it. A sub-committee had not been set up for the particular subject in which Mr. Ryder was interested. The question of finance had to be considered. These sub-committees cost money and, while the membership was growing, it must be borne in mind that it was impossible to start a dozen sub-committees at once.

The CHAIRMAN thought that, in fairness to the council, members ought to know that if a request was received from a Government department to set up a small sub-committee to help them in their deliberations, the council felt that it had got to be done. They had had a request to set up an enlarged Raw Materials Committee, which was quite as necessary to trade as research. Good work was being done, and indeed this kind of thing had to be done, particularly when the Director of Housing asked them to undertake it. They could not, in matters of this nature, do everything, and he knew there was a lot that they could still do. He felt, however, that they were doing everything possible, and he hoped members would not be disturbed by anything Mr. Gardom had said.

Competition in Research

MR. G. H. ABBOTT said that in the general structure of the Institute the council was a kind of Supreme Soviet. The Institute was a technical body, and he could not see why the council should not be a technical body, and the work be carried on by sub-committees. Members might have seen a report in the Press about the Vitreous Enamellers' Association, from which it certainly appeared that they must expect some competition in the matter of research policy, technical publicity and that kind of thing. No doubt the Institute council had taken a note of that.

MR. GARDOM agreed that the Institute was a technical association, and even he was afraid to say that the council was not technical. He thought they would consider themselves technical and, frankly, the technical committee had been formed out of the council so far. The technical committee was responsible to the council.

There was only one body elected by members to run the Institute, and that was the council. When he made the suggestion that the technical committee should be running side by side, it would still be responsible to the council. Technicians—and they were all technical men on the council—were forced to do other work, and that was administration. That was where the council, in his opinion, were getting a little bit overworked with other things, and he thought that by separating them somewhat they would get more work done. He was an idealist; he wanted a thousand sub-committees. With regard to the V.E.A., there was the question of co-operation. The Institute knew, he thought, exactly what that body was doing, and they knew what the Institute was doing, and they were working very closely together.

MR. ABBOTT thought the Institute might achieve better results from Mr. Gardom's point of view if it was accepted that the council was a technical body and that sub-committees were directly responsible to the council. The other matters to which Mr. Gardom referred might perhaps be delegated to the V.E.A., which was the recognised commercial body. Similarly, the research activities of the V.E.A. might become the technical responsibility of the I.V.E.

MR. J. H. GRAY urged that a matter which should receive attention in the immediate future by the technical committee was the great demand for steel and the short supply, which would probably become more acute.

MR. GARDOM asked if, by a slight lowering of the quality, they could get greater quantities, could they use the material. He was all for quality.

The CHAIRMAN assured Mr. Gray that note would be taken of his observations and that the matter would be discussed at the next meeting of the council.

Proceeding to present his report as hon. treasurer, the chairman mentioned that £250 had been transferred to the research account, against £100 in the previous year. The surplus on the year's working was £4 4s. 2d. In the previous year the surplus was £21 4s. 4d. Subscriptions brought in £536 11s., compared with £466 4s. The research account now stood at £685, against £435.

On the proposition of Mr. C. P. Stone, seconded by Mr. A. Forshaw, the report was approved.

Election of President

The chairman recalled that 12 months ago Mr. R. J. Rogers became president-elect. The presidency of a technical institute was usually a nominal appointment, the president acting as a figure-head. The Institute had had two notable exceptions to that rule in Mr. Whittle

and Mr. Gardom. Last year another name was put forward which they were prepared to accept at its face value. They were also prepared for the gentleman named to act as a figure-head. He assured them, however, that during the past year Mr. Rogers had taken a keen and active interest in all that the Institute was doing. He had travelled up to London and attended meetings and had served on some of the sub-committ'ees. To date, in what was really an unofficial capacity, Mr. Rogers had made a most valuable contribution to the activities of the Institute. It was therefore with the utmost confidence that he proposed the election of Mr. Rogers as president, knowing full well that he would do much to ensure the future success of the Institute.

MR. A. MCLEOD, who seconded the proposition, said it was with the greatest pleasure that the London section welcomed Mr. Rogers a few weeks after he became president-elect. Members appreciated the interest taken in the sections by the senior officers. The work that Mr. Rogers had done for the Institute in the past 12 months amply bore out the promise of that first gesture. He (the speaker) looked forward to Mr. Rogers' year of office and wished him well.

On the chairman putting the motion to the meeting it was carried unanimously.

MR. GARDOM, as the immediate past-president, then invested Mr. Rogers with the presidential medallion. He himself, he said, was the first to wear it, so that he could assure them that it was now going round the neck of the best man that had ever worn it.

PRESIDENTIAL ADDRESS

The PRESIDENT, in acknowledging his election, expressed his great appreciation of the honour. Although he had not been intimately connected with the work of the council until he was appointed president-elect at Cardiff, last year, he had, nevertheless, followed the fortunes of the Institute from—he could say—the very day of its inception. He happened to be at the British Industries Fair when Mr. Gray called together some of those who were particularly interested in forming an institute, and although he (Mr. Rogers) did not take part in any of those proceedings, he kept himself informed as to what was happening, because he sincerely felt that there was need for a technical institution to deal with the many problems connected with the enamelling industry. During the past year, so far as his time allowed, he had endeavoured to understand something of the detailed work that was being carried on, and he assured members that it would be his earnest endeavour during his term of office to put himself at the service of the Institute. They could depend upon it that he would do his best to support the council and the interests of the members in every possible way. He felt, as he was sure they all did, that to-day, possibly more than at any time in our industrial history, it was necessary for bodies of men interested in a particular industry to collaborate and organise themselves into one strong body. As an industry, they did not know what they would have to face in the future, and the stronger they were the better it would be for the industry and for themselves as individuals. It was therefore with great pleasure that he heard of the progress in the membership. They now had 280 members, and he hoped it would soon be possible to say that the Institute covered the whole of the various activities of the vitreous enamelling industry. Personally, he would not feel satisfied until, as a technical body, they were fully representative of the whole industry, so that they could say to Government departments, or anyone else, that they spoke for the industry. He again thanked members for the honour done him, and promised to give the Institute his best services.

MR. H. H. ASTON proposed that Mr. John Gardom, immediate past-president, be made an hon. life member and be asked to attend all future council meetings.

MR. C. J. BAINES seconded the proposition.

The CHAIRMAN, speaking in support, said Mr. Gardom set a high standard for himself and everyone else.

The PRESIDENT suggested that they should couple with the motion before the meeting a hearty vote of thanks to Mr. Gardom for his services as president during the past two years. While they knew that Mr. Gardom had taken the work in his stride, he had so many activities that they hoped he would tone down a little bit.

The combined proposition was heartily endorsed by the meeting, and Mr. Gardom returned thanks.

Election of Council Members

The result of the ballot for the election of three council members was announced by the chairman as follows: Mr. Todd, Mr. Hallsworth and Mr. Biddulph, in the order given.

Mr. W. S. Grainger was reappointed hon. treasurer, thanks being expressed to him for the way in which he looked after the finances of the Institute.

Wenham Bros., Birmingham, who, the chairman said, he thought had been auditors since the inception of the Institute, were re-elected to this office at the same fee as last year.

Before declaring the meeting closed, the chairman mentioned the receipt of a letter from Mr. Bernard Kent stating that he accepted an invitation from the Porcelain Enamel Institute of America to attend the annual forum at the University of Illinois. He conveyed to the American Institute best wishes and greetings from the I.V.E. The forum was intensely interesting, the Papers and lectures being of a very high standard. The next annual forum was being held at the University of Ohio in Columbus next September, and members of the I.V.E. were invited to attend.

THE SIXTH ANNUAL CONFERENCE of the [South African] Meehanite Research and Development Associathan 19 technical Papers were presented, and among than 19 technical Papers were presented, and among them was one illustrated by a film strip lent by the C.F.A. and dealing with the making of cast-iron crankshafts at Ealing Park Foundry.

NOTES FROM THE BRANCHES

EAST MIDLANDS.—Mr. H. Bunting presented a Paper entitled, "Thirty Years of the East Midlands Branch," from which we briefly record the following.

The branch was the outcome of the Leicester and district branch of which Mr. S. H. Russell was the secretary. After the 1914 convention, held at Leicester, it was thought that the Leicester and district branch needed widening, and on June 24, 1915, a meeting was held at the Royal Hotel, Derby under the chairmanship of Mr. Sydney Gimson when it was decided that a branch be formed and named the East Midlands branch of the British Foundrymen's Association. A council was elected consisting of Mr. F. G. Chambers, Mr. J. Hegg, Mr. R. H. Russell, Mr. H. Bunting, Mr. S. Potts, Mr. V. Jobson, Mr. W. Byron, Mr. W. S. Wright, and Mr. H. Pemberton, honorary secretary.

On August 30, 1916, a meeting was held at Derby when Mr. R. T. Russell was elected the first president of the branch, and Mr. H. Bunting as hon. secretary. The council consisted of Mr. Chambers, Mr. Hegg, Mr. Jobson and Mr. Pemberton.

In 1926 the branch took a very important step, at the general council meeting held in London in June, the branch representatives were of the opinion that it was time they had a convention. There was only one choice at that time—Mr. S. H. Russell; as Mr. Russell was not at the meeting it was necessary that contact be made to ascertain if he would stand, therefore the nominations for junior vice-President were held over till this was done. Steps were then taken to make arrangements for the 1928 convention at Leicester.

The Paper ends with a comparison of subscriptions received in the first year of the branch and last year. The first amount was £21 9s., while in 1945 the total (with the Lincoln section) was e431 19s. 6d.

In the discussion which followed, Mr. Lucas, Mr. Spiers, Mr. Dunleavy, Mr. Docksey, and Mr. A. E. Peace participated. Mr. Peace said that he believed the East Midlands branch was the forerunner in the presentation of short Papers. He was not sure of the date they were introduced, but he remembered being persuaded to give a short Paper 22 years ago. The procedure had done a tremendous amount of good in bringing on young people to present Papers.

Mr. Hallam proposed a vote of thanks which Mr. Wardle seconded.

The 12th annual report of the Imperial College Union reveals that commendable progress has been made in the development of placing students in works during their summer vacation. The first year only 31 students were placed; this year the number was 583. Of the 61 concerns participating in the scheme, a high percentage are foundries. It has been possible during the year under review to receive about 22 European students in British works, and to send to foreign workshops a like number. It is desirable that this system should receive the widest publicity in order that it may spread to other Universities. It would be helpful to those who, like ourselves, are constantly receiving requests from abroad to place students in British foundries. Obviously a reciprocal system is ideal.

METAL FINISHING RESEARCHES

B.N.F.M.R.A. TACKLE PROBLEMS

During the war metal finishing problems were of a specialised nature, but the return to normal production requires decorative finishes of a high order particularly for goods to be sold overseas in competition with those from other countries. Finishing processes have, therefore, become of primary industrial importance.

Owing to the present wage level, finishes of the required standard can only be achieved economically by taking advantage of the most up-to-date methods.

The Research Board of the British Non-ferrous Metals Research Association has decided that an extension of the facilities in the Association's own laboratories to provide for researches on metal finishing would offer an economical and efficient method of tackling these problems. Before the war the Association's interest in electro-deposition was dealt with by co-operation with the Research Department, Woolwich. It is considered, however, that the Association is in a unique position to serve the metal finishing industry by undertaking in its own laboratories researches on metal finishing processes in parallel with the work on other aspects of metal quality which has been its concern for so many years.

Extension of Laboratories

The Association is therefore embarking on a considerable extension of its laboratories to provide, amongst other things, facilities for a metal finishing section. This will include an experimental electroplating shop and a special laboratory for research of a more fundamental kind. The work of this section will be under the immediate supervision of Mr. E. A. Ollard who is well known in the elctro-plating industry.

These new research faciiities, coupled with the information and technical advisory services which the Association provides for its members, will place at the disposal of British plating firms the same strong technical backing which has already proved so valuable a support to other branches of the non-ferrous metals industry.

This extension of the Association's work has been made possible by the support which has been received from certain members in the past, but if the industry is to reap the maximum advantage from this development, the co-operation of a much wider section of the metal finishing industry must be secured. The Association wishes, therefore, to make contact with all firms interested in this project and invites any company concerned with metal finishing in any form (other than paint or lacquer) to write immediately to the Director, British Non-ferrous Metals Research Association, Euston Street, London, N.W.1, stating the type of work with which it is concerned.

THE CURRENT BASIC PRICE for pig-iron in Italy is 18,500 lire per metric ton loaded on wagon at producers' works. The value of the lire is somewhat variable, depending on how and where lire are bought.

PRODUCTION OF HIGH QUALITY STEEL

Showing of Hadfields' film to London branch

The meeting of the London branch of the Institute of British Foundrymen on October 30, was devoted to the showing of Hadfields, Limited's film on "The Production of High Quality Steel," with its commentary by Wilfred Pickles. About 200 members and visitors—the largest audience ever attracted— attended at the Gaumont British Picture Corporation's theatre at Film House, Wardour Street, London, W.1.

Mr. G. R. Webster (branch president) presided, and Mr. W. H. Salmon, F.I.M. (of Hadfields, Limited), presented the film, and answered questions afterwards. Mr. Salmon is past-president of the Sheffield branch.

The film showed steel-making by the crucible, basic and acid open-hearth, basic arc electric and high-frequency electric induction furnaces; the working of 60-ton tilting (basic) and 40-ton fixed (acid) open-hearth furnaces, and the use of immersion pyrometers and spectrographic analysis; prepartion of ingot moulds and the control of the rate of pouring.

It showed also the rolling of ingots to blooms and billets in a 28-in. cogging mill; the removal of scale and surface defects by oxy-acetylene blowpipes in a deseaming plant; the inspection of the billets; pickling, magnetic crack detection, a forged upsetting test to detect flaws, the rolling of billets to bars in 11-in. and 14-in. merchanting mills; the working of steel by pressing and forging; the operation of 15-ton basic arc electric and 1-ton high-frequency melting furnaces.

On the laboratory control side there was shown the metallographic examination of test specimens from each heat of steel by deep etching, sulphur prints, printers' ink test, and for grain size and inclusion counts; crack detection by supersonic methods, and the determination of tensile, hardness, ductility and shock resistance properties.

Mr. Salmon said the film was made during the last few months of the war, with the idea of helping our export trade, and for showing in schools and technical institutes to attract young men to take up technical work. It had cost some £6,000; the cost of the lighting alone was £3,000. The film was dedicated to the memory of Sir Robert Hadfield, whose researches have played so great a part in the development of alloy steels.

DISCUSSION

MR. V. C. FAULKNER (past-President of the Institute and of the London branch) asked why the moulding side was not included among the features shown in the film, bearing in mind that Hadfields had a very important foundry.

MR. SALMON replied that the film was the first of a series which would cover the company's various products and activities, and the foundry had not yet been filmed.

MR. E. J. WILLIAMS asked whether photo-electric cells were used in any of their processes.

MR. SALMON said the photo-electric cell had been used in the side-blown and bottom-blown processes to determine the carbon end point; the flame could be a very good indication of the end point, so long as smoke did not interfere. It had been used in this country and in America.

A SPEAKER asked at what stage the header was discarded, the header being the part in which the main impurity collected.

MR. SALMON replied that the material was rolled down to 15-in. square sections, and then the headers were cut off.

MR. C. CLEAVER felt that the use of a coke brazier for drying and heating ladles before filling was rather primitive, and he wondered whether there was any better method of preheating them. Probably, he said, some coke was dropped from the brazier, and he asked whether that was likely to affect the carbon content of the steel. No doubt the ladles were cleared out after preheating, though that was not shown on the film.

MR. SALMON said the ladle which was preheated by means of a coke brazier, as shown in the film, was a 60-ton ladle; the amount of heat that could be transferred to the ladle by other means was very small as compared with the heat in the molten steel; one could not get the ladle sufficiently hot for the same fuel consumption by other means. Any dust that remained in the ladle after preheating was sucked out by means of a vacuum. In the case of smaller ladles, such as 6-ton ladles, for example, it was often sufficient merely to ensure that they were properly dried.

Production of the Film

MR. R. B. TEMPLETON (vice-President of the Institute), who offered his hearty congratulations to Hadfields on their very instructive film, asked how long it had taken to produce. He had in mind that he had watched the making of films near his own home, and had noted that a photographer would spend a day in taking a particular shot which would just flash by in a matter of seconds on a screen. He asked what was the principle involved in the supersonic method of testing for flaws.

MR. SALMON replied that, before the film was made, a screen writer came to the works and had a look around in order to obtain "atmosphere." When all the technicians and the film people had agreed as to what would be taken, the film unit had spent about three months at the works. Then the shots were taken away and cut to pieces, and the film was prepared without the spoken commentary. After that the music and commentary were added. About a year had elapsed by the time the film was completed.

As to the principle of the supersonic method of testing, he said that mariners were able to ascertain the depth of the ocean at any particular point by

Production of High Quality Steel

tapping on the bottom of the ship and counting the number of seconds that elapsed by the time the echo came back; that was aural. If the sound waves were made to travel more quickly by using electricity, that was supersonic. Similarly, aeroplanes which travelled faster than sound were supersonic. By the use of the supersonic method as applied to testing steel for flaws, the steel could be tested on one day in order to see the effects that occurred, and could be tested again on the following day in order to watch development. The defects looked like threepenny-bits across the fractures.

MR. FAULKNER asked if the method was applied to castings.

MR. SALMON replied that it was not; it must be applied to a fairly uniform section.

MR. GRAHAM asked if the supersonic method was 100 per cent. efficient, or whether flaws were likely to be missed; and whether it would detect hydrogen embrittlement.

MR. SALMON said that it was rather too efficient, for it was liable to show defects which were not there! It could be used to detect hydrogen embrittlement.

MR. WILLIAMS asked if films such as that of Hadfield's would be shown to the public in the cinemas during the "Foundry Week" which he understood was to be arranged in this country.

MR. FAULKNER said the Government were proposing to organise an intensive campaign in order to attract labour to the foundries. Half-minute films would be shown in the cinemas, there would be talks on the radio and many other things. It was due to start about now, but apparently the Government were not yet quite ready.

Electro-magnetic Method for Testing Steel

A SPEAKER asked whether the electro-magnetic method which had been used for testing steel for defects had been developed for use with non-ferrous metals. He also asked whether there was very accurate control of the amount of metal removed when applying the oxy-acetylene method of surface treatment.

MR. SALMON replied that for the electro-magnetic method of testing non-ferrous metals the cadmium plating process was used. Normally, after the metal had been aged and cooled, a defect would not be apparent, but if the metal were cadmium plated, the defect would show up all the time. The girl workers could quite easily detect cracks by that method.

The oxy-acetylene de-scaling process was applied to the surface of ingots, etc., merely for the purpose of removing the scale formed in the heating process, and which might lead to further defects.

MR. GREEN mentioned that the electro-magnetic method of examination had been developed for use with manganese-bronzes. It was found that when there was a good percentage of iron there was sometimes a tendency to segregation of an iron-zinc constituent, and that was shown up by the electro-magnetic method.

Inclusions in Steel

MR. WILLIAMSON recalled that two years ago he had drawn up some specifications in which maximum limits were specified in respect of inclusions. He had submitted specifications to some of the Sheffield firms, who had stated that it was impossible at that time to guarantee that inclusions would be within specified maxima. He asked whether Hadfields could give such a guarantee now.

MR. SALMON said the trouble was that the amounts of inclusions would vary as between the different parts of the ingots. For many years, he added, the Iron and Steel Institute had been trying to produce the perfect ingot, but he did not think they had succeeded yet. He did not think it would be possible to give such a guarantee.

MR. WILLIAMSON added that one firm said they could do so, at a price! He was inclined to agree with Mr. Salmon, however, that the prospective buyer would probably not be prepared to pay the price.

A SPEAKER, commenting that some high-duty alloy steels were exceptionally "dirty," said the general impression gained from discussions was that the number of inclusions was so great that, after being stirred up in the furnace, they had not time to settle. He asked whether that difficulty had been overcome.

MR. SALMON said the remedy was to allow the particles of inclusions to coagulate together into bigger ones, which would rise out of the molten steel before it was poured into the ingot mould.

MR. GRAHAM asked whether there was any method available for ascertaining when the process of aggregating the small non-metallic particles, so that they would rise out of the molten steel and could be eliminated, was complete. He had in mind that a steel might be very uniform throughout the greater part of its mass, but might contain occasional masses of inclusions: that would suggest that the process was not completed.

MR. SALMON replied that the amount of the inclusions and their shape depended on the state of oxidation of the bath; so far the chemist had not been able to tell the steel-maker exactly when to teem them from the furnace.

Life of Ingot Moulds

MR. KING asked what was the normal life of ingot moulds.

MR. SALMON said that it varied from 100 to 300 or 400 pourings. It was very important to maintain continuity in the use of the moulds so that they were not allowed to cool, for it was the heat shock which cracked them.

MR. ROSS commented on the excellence of the lighting effects and of the background in the "shots" on the film, and said that the film should have a great propaganda effect abroad.

MR. SALMON said the film was made towards the latter end of the war period, when black-out conditions still obtained, and the film men were thus able to put the lights just where they wanted them. Had there been daylight in the shops as well, perhaps the results would not have been so good. One felt, on seeing the film.

that the cost of £3,000 for the lighting alone was justified.

MR. ROSS, referring to the cooling of ingot moulds, said the Germans had been using forced draught cooling.

MR. SALMON replied that the moulds were often cooled quickly for re-use; but the point was to keep them in circulation and not to allow them to become dead cold before re-use.

Immersion Pyrometers

A SPEAKER asked what was the final solution of the troublesome problem of the immersion thermocouple.

MR. SALMON replied that in the high-frequency furnaces the Schofield instrument was used, protected by a silica sheath. It could be as long as one wanted it, and an indication was obtained in eight or nine seconds. For a big furnace the equipment had to be carried on a trolley and balanced before it went into the furnace. In the past they had banked on the use of optical pyrometers, but it was found that the results might be easily 50 deg. wrong. Therefore it had been necessary to use immersion pyrometers for molten steel.

MR. E. H. BROWN asked what was considered to be the minimum temperature for ingot moulds, from the point of view of maintaining reasonably long life.

MR. SALMON said he did not think it was possible to say what was the minimum temperature, for there were so many variables. It was a question to be decided by people who had had years of experience. His company used contact couples to ascertain the surface temperatures, and in experimenting on the problem only one of the many variables could be altered at one time.

Furnace Types and Products

MR. F. ARNOLD WILSON asked what furnaces were used for the different types of steel.

MR. SALMON said the high-frequency furnaces were used mainly for foundry castings of various compositions, for it was very easy to use different compositions for each heat. The basic electric furnaces were used for the very high quality steel. The basic open-hearth steel could never be as good as the basic electric steel, because in the basic open-hearth furnace one could not be sure of limiting the sulphur and phosphorus contents to as low a figure as in the basic electric. The bigger furnaces were used by firms who were concerned with the making of common steels in large quantities.

Process Control

A SPEAKER, referring to ingot reheating for rolling and ingot heating for forging, said he had not noticed the use of optical pyrometers of any kind of heat control when looking at the film. It would seem strange if that were left to the good offices of the craftsman, particularly bearing in mind the great amount of scientific work undertaken in connection with the processes generally.

MR. SALMON replied that optical pyrometers were used, and the craftsman was not allowed to spoil an ingot because the temperature was not right. It was worse to have the ingot too hot than too cold. A tremendous number of optical pyrometers was used, there being some 30 or 40 men around the works measuring heats.

MR. SMITH, who asked whether high-frequency induction heating had been considered for the heating of billets, said he was inclined to think that, in view of the capital involved, it was probably out of question at the moment; but if one were starting from the beginning it might be worth considering for the heating of billets.

MR. SALMON said it was used for surface hardening, but the plant would cost a lot for heating large billets.

MR. SMITH added that one was impressed, when seeing the film, by the enormous amount of plant that was involved in such an undertaking, and the very large capital expenditure it represented.

MR. SALMON agreed. He added that the plant shown in the film represented only part of the total; they had not seen the foundry yet. When asked if that would be filmed in the future, he said it probably would if conditions permitted.

THE BRANCH-PRESIDENT asked if there were a demand in this country for vacuum melting and pouring as applied to the high-frequency furnace; and whether Hadfields had used the Jazkinski type of pressure head.

MR. SALMON replied that vacuum melting was developing mainly in Germany for high-nickel steels, because nickel was one of the things which did not cause much trouble in melting. They were all anxious to be able to remove the gases from molten metal and to produce gas-free ingots; but it cost money to make the furnaces vacuum- and pressure-tight.

The Jazwinski type of pressure head was used on sand moulds, but had not been applied to ingot moulds.

Vote of Thanks

MR. WILLIAMS, proposing a hearty vote of thanks to Hadfields for having allowed the film to be shown, and to Mr. Salmon for having presented it and replied to the discussion, said the film had been most entertaining. There was no suggestion of acting anywhere, and one was impressed by the very fine team work it displayed. The work on the scientific side was also most enlightening.

MR. HOLLIGAN, who seconded, said the film was most inspiring, and he complimented Hadfields on their enterprise. Bearing in mind the perfection of the film, one was surprised that it had not cost more than £6,000. (The vote of thanks was carried with acclamation.)

MR. SALMON, responding, commented on the enthusiasm displayed by the meeting, and said the branch had provided the best discussion he had heard on the film.

THE LANCASHIRE CONTRACTORS' PLANT COMPANY, LIMITED, is being wound up voluntarily. Mr. E. E. Coventry, 2, Abbotts Road, East Ham, London, E.6, is the liquidator.

RELIGHTING A STEELWORKS FOUNDRY

A comprehensive scheme for relighting the Park Gate Iron & Steel Works, at Rotherham, was recently completed by Lilleker Bros., Limited, of Rotherham, who worked to plans prepared by lighting engineers of the British Thomson-Houston Company, Limited. When a preliminary survey of the works was made, all departments were found to have service intensities as low as 0.56 foot candles and, in addition, the work of the operatives was hampered by the poor spacing and low mounting height of the high wattage lamps which permitted heavy shadows and gave a great deal of glare. A detailed relighting scheme was prepared for each department and recommendations were made which would not only increase the service intensity very considerably, but would also relate the spacing and mounting height of the lamps to the nature of the work normally carried out. Wherever it was found necessary to mount reflectors high above the floor level a 5-amp M.K. fuse plug was wired in circuit so that each individual lamp could be switched off for cleaning and maintenance without affecting the remainder of the installation. Sixteen 400-watt Mercra (mercury vapour) lamps in Mazdalux dispersive reflectors were installed in the foundry. These were mounted at a height of 23 ft. above floor level and their spacing staggered at intervals of 28 ft. by 20 ft. Visors were fitted to the reflectors to protect the lamps from soot and dust, and the result has been a high quality lighting of an average intensity of 12 foot candles.

FIG. 1.—VIEW OF THE FOUNDRY.

HOUSE ORGANS

Light Metals Research, Vol. VIII, No. 1, published by the British Aluminium Company, Limited, Salisbury House, London Wall, E.C.2.

The receipt of this excellent house organ carried the reviewer's mind back to pre-war days, when it and its companion publication—"Light Metal Review"—were the standard source of information on the general progress of the light alloys. The reviewer welcomes its return, and notes with interest that the earliest review was made in 1943, and the bulk are of comparative recent origin. To attempt to resume where it left off would be an impossible task and the correct course has been taken. As was the case in pre-war days a selected list of Patent applications is included.

Sif-Tips, the house organ of the Suffolk Iron Foundry (1920), Limited, Stowmarket, in its 1946 summer issue, contains interesting articles on the repair of iron castings and on aluminium welding.

INGOT MOULD PRACTICE

(*Continued from page* 326.)

CONCLUSIONS

From the above, a few points stand out in relief. At the Creusot Steelworks, where the ingot moulds fail quite often from cracking, the open-grained irons apparently give the best results. In the actual period where the irons have not always the desired ferrite-graphite structure, the graphitisation anneal has proved to be a real improvement. Certain additions, such as Ti-Va and Cr-Ti irons, have shown themselves to be worth while, and should receive more attention. There are at the present time, in course of being tested, ingot moulds which have been inoculated with calcium silicide, the results of which will not be known for several months. There still remains much to learn in the field of the making of ingot moulds, and it is only by the mutual discussion of all their problems that the foundrymen will assure themselves of real progress in this industry.

INGOT MOULD PRACTICE*

By M. CHARMEAU†

The essential properties of ingot moulds were first dealt with, and an analysis of the factors tending towards their practical production was given. A steelmaker, desiring to produce sound ingots, free from surface defects, of the shape and size decided in consultation with the forge and rolling mills, requires from the foundryman the following:—(1) Conformity to dimensions, especially uniformity of sections; well-finished smooth interior surfaces free from waviness; blowholes, scabs or other foundry defects affecting the skin. The base of the ingot mould and the shoulder must be perfectly flat. The moulder must be made to realise these economic conditions, involving a minimum of chiselling or grinding by perfecting his moulding technique; (2) the ingot moulds must conserve for the longest possible time their initial properties in order that a maximum number of ingots can be cast. This quality is more difficult to reproduce than the former because there are two main causes acting together towards the destruction of the ingot moulds: (*a*) cracking and disintegration of the internal walls, at the end of an indeterminate time the skin of the ingots becomes inacceptable and stripping impossible, and (*b*) shrinkage cracks of one or more walls, in which case the ingot mould is rapidly or even immediately scrapped.

Disintegration of the Internal Walls.—This is due to (1) Graphitisation of the mass; (2) oxidation of the graphite and ferrite (these two actions set up swelling and surface cracking); and (3) unequal expansion of the inside and outside walls also set up internal tears. Graphitisation can be overcome by (1) Stabilising the cement by lowering the silicon content, increasing the manganese content, or by chrome additions; (2) producing an iron having a ferrite-graphite structure in the as-cast state, an iron containing more than 6 per cent. silicon; (3) graphitising the ingot mould before placing in service by heat-treatment.

Oxidation.—The irons most suited for resisting oxidation are: white or mottled; pearlitic irons containing but little graphite, the latter being fine and evenly dispersed.

Reduction of Internal Cracks.—This can be effected by (1) *Expansibility of the iron.* An iron of low expansion will carry the least stress, but all grey, white or mottled irons have pretty much the same coefficient of expansion. (2) *Heat conductivity of the iron.* A high conductivity is to be sought. Some authors state that irons carrying fine and well-dispersed graphite should have the best conductivity. (3) *Mechanical strength.* Stresses are proportional to the modulus of elasticity of the iron; irons of large grain size have a low modulus and should be suspect.

Importance of Thermal Factors.—Graphitisation, oxidation and stresses are proportionally increased as the temperature reached is higher and the time of heating prolonged. Thus it is best to cast the steel as cold as possible in cool ingot moulds, and to strip the ingots as soon as possible.

Mechanism of Cracks.—Some ingot moulds are scrapped after the first cast through cracking. Internal stresses, due to a hard core or to a non-isothermed cooling, or internal defects; blow holes or shrinks can be a possible explanation of this happening. The moulder should do his best to avoid these defects. It can be stated that these cracks occurring during the first cast on ingot moulds stabilised by thermal treatment do not show any defect at the fracture. On the other hand, ingot moulds cracking after a large number of casts should have had their original internal stresses removed. M. Dudouet, who has investigated this phenomenon, from which the following is culled, indicates that there are three factors influencing the formation of cracks: (1) The incidence of swelling; (2) the relative size of the graphitised zone and the unaltered exterior zone, and (3) the deformability of the iron used. Swelling has already been referred to. The relative size of the two zones mentioned above increases with time, and so explains fractures through cracking after a large number of casts. A ferrite-graphite structure is the most suitable for exhibiting the highest deformability; six per cent. silicon irons have this structure but they are mechanically weak. A few blast furnaces make irons carrying this structure. In conclusion, it would appear that irons which best conform to the requirements—high resistance to surface degradation and cracking are those which have a ferrite-graphite structure with carbon-silicon contents as low as is compatible with this structure. The addition of chromium should be limited to small amounts. A graphitisation heat-treatment before use can increase the life of an ingot mould cast in an iron having a not entirely suitable composition.

The Henri Paul foundry (Le Creusot) supplies the steelworks each year with 6,000 tons of ingot moulds of various types, ranging from test moulds of 16 lb. up to those weighing 100 tons. The castings are divided into three categories: (1) Ingots for tool steel; (2) the common type weighing from 16 cwt. to 5 tons; and (3) the larger type for forging and plate mills.

For the moulding of the small ingot moulds, the cores are made from silica sand mixed with an organic bond. The moulding of the large ingot moulds, being a speciality, is dealt with in some detail.

Organisation of the Moulding Shop

The moulding shop is divided into gangs of two operatives; each gang is provided with a platform set at the height of the upper level of the patterns. The moulding sand is discharged, directed on the platform by a bottom-opening skip of 15 hectolitres. It is suspended from a high-speed overhead electric travelling crane spanning the sand preparing shop. The moulders work on the platform and so have but little handling to do to fill the moulds and core boxes. Each gang is provided with an electric jib crane for its own use.

Patterns and Core Boxes.—These are of wood, well made and extremely robust. The wide range of types

* Presented at the 20th annual congress of the Association Technique de Fonderie.

† Schneider et Cie, Le Creusot.

Ingot Mould Practice

of ingot moulds and the variations and changes in shape do not permit of the supply of metal patterns.

Tackle.—For each ingot mould, special moulding boxes are available: the mould is made up of a bottom-part, two split middle-parts so as to allow but a minimum of sand around the pattern, and a top-part. These parts are assembled by clasps and wedges.

Cores.—This essential part of the mould is carried out in dry sand, carrying a modicum of mineral blacking. But for a few exceptions, core irons are not used, the core being supported by a base plate. It is hollowed out centrally by a slightly conical mandrel, steel rods are placed near the angles of the core before ramming, forming after removal, the indispensable vent holes. Ramming is carried out as in the case of the mould by pneumatic rammers. After leaving their boxes, the cores are carefully brush-blacked using good material, and finally smoothing down.

Stoving.—The ovens are close by in the moulding shop. The cores are dried during two 8-hr. periods at 350 deg. C., and the moulds, once only.

Casting.—The ingot moulds are cast in the "as-used" position, using a large number of small jet runners of circular section. The casting temperature is about 1,240 deg. C.

Stripping.—The boxes are removed the day following casting, but final stripping only takes place after complete cooling.

Preparation of Metal.—Melting is carried out in cupolas, having two rows of tuyeres and no receiver. The charge is made up of 50 per cent. open-grained hematite of the following composition:—T.C., 3.8; Si, 2.7; Mn, 0.8; S, 0.04, and P, 0.10 per cent., and 50 per cent. of broken ingot mould scrap. Melting is carried out with 8 per cent. coke. Final analysis is of the following order:—T.C., 3.4 to 3.5; Si, 2.4 to 2.5; Mn, 0.8; S, 0.10, and P, 0.10 per cent. All ingot moulds carry a serial number and the date of making to facilitate identification.

Life Prolongation Researches

The working conditions for ingot moulds at Le Creusot Steelworks are pretty severe. It manufactures special steels, or steels which necessitate a prolonged time in the ingot mould before stripping (three hours for a bottom-poured sq.-sectioned ingot mould of 600 mm.); the cooling of ingot moulds laid on their sides and two high; using the same set of ingot moulds once a day or more often, because of the great diversity in production and the impossibility of adequate reheating sufficiently high to protect the ingot mould walls. [Against thermal shock?]

Influence of the Structure of the Metal.—Several types of ingot moulds have been cast with close, open and mixed grain of virtually the same composition. The average consumption has been:—

18.4 kgs. per ton of steel for open-grained iron.
24.9 kgs. per ton of steel for close-grained iron.
26.5 kgs. per ton of steel for mixed-grained iron.

Showing a clear gain in favour of the open-grained material.

(1) *Swedish Iron.*—Some bottom-poured 600 mm. square ingot moulds, carrying a feeding head made from a mixture carrying 45 per cent. of grey Swedish iron (Brand AJ) in the charge, have ben tested against normal ingot moulds, but they showed no superiority.

(2) *English Iron.*—Two series of tests were made, one with 100 per cent. of new iron, and the other with 50 per cent. pig and 50 per cent. heavy scrap, using the Millom brand. The ingot moulds have given a higher yield of casts, of the order of 10 per cent. improvement over normal practice. The use of this iron is not economic.

(3) *Ti-Va Iron.*—The charge carried 30 per cent. of titanium-vanadiferous pig, and 70 per cent. hematite. The ingots show an increased life of 20 per cent. over normal practice.

(4) *Cr-Ti Raty Pig.*—The first test was with 25 per cent. of this pig in the charges. The results showed no improvement in mould life, but they had a better internal surface associated with a tendency to cracking. A second test was made, but with a reheating of the ingot moulds after 30 casts. A gain of 20 per cent. was registered on the consumption of ingot mould per ton of steel cast.

Influence of Alloying

(1) *Copper.*—An addition of 0.5 per cent. showed no perceptible benefit.

(2) *Chromium.*—Small additions of the order of 0.16 per cent. have a beneficial influence. Increased to 0.5 per cent., it gave disastrous results arising from moulds cracking at the first cast.

(3) *Phosphorus.*—Casts made from metal containing 0.2 per cent. P showed a normal life. Those containing between 0.3 and 0.4 per cent., prematurely cracked.

Influence of Thermal Factors

(1) *Rate of Cooling of the Ingot Mould after Casting.*—Numerous rapid and slow cooling tests, carried out in air, in the mould, and in the stove, showed that this factor was of secondary importance.

(2) *Thermal Treatment for the Removal of Stresses.*—Ingots undergoing thermal treatment at 550 deg. C. have shown no better life than others not so treated. There are, without doubt, no internal stresses in the Author's ingot moulds in the "as-cast" state.

(3) *Graphitisation Anneal.*—On certain types of ingot moulds, particularly those liable to cracking, a heat-treatment at 850 deg. C. has resulted in a 50 per cent. reduced consumption of ingot moulds. In fact, all ingot moulds are heat-treated.

Ingot moulds made of pearlitic cast iron all failed prematurely through cracking. Ingot moulds with cored bands (collars) in the thickness unannealed were distinctly poor; with an anneal they showed an increased life. It is very difficult to establish satisfactorily a research programme for ingot moulds, as the numerous factors involved in their use seriously influence their life. It is essential, for progress to be made, that a close and loyal collaboration between steelworks and foundry be established.

(*Continued on page* 324, *foot of column* 2.)

FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

NOVEMBER 28.

Royal Statistical Society (Industrial Applications Section) :—"Efficiency of 100 per cent. Inspection," by D. Newman. At the University, St. George's Square, Sheffield, at 6.30 p.m.

NOVEMBER 29.

Institution of Mechanical Engineers :—"Aircraft Propulsion." by F. M. Green and J. E. Wallington. At the Institution, Storey's Gate, London, S.W.1, at 5.30 p.m.

DECEMBER 2.

Society of Chemical Industry (London section) :—"Foams and Fire Fighting," by Dr. N. O. Clark. At the Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1.

DECEMBER 3.

Sheffield Metallurgical Association :—"The Mechanism of Sheet-metal Drawing," by Dr. J. White. At the Metallurgical Club, West Street, Sheffield, at 6.30 p.m.

DECEMBER 5.

Chemical Engineering Group :—"Industrial Application of Activated Alumina to Adsorption Drying," by J. W. Carter. At Bristol.

DECEMBER 6.

Institution of Mechanical Engineers :—"Free-piston Compressor Engines," by H. O. Farmer. At the Institution, Storey's Gate, London, S.W.1, at 5.30 p.m.

Keighley Association of Engineers :—"The Steam Locomotive," by Dr. A. W. Tuplin. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Manchester Association of Engineers :—"Developments in Ship Propulsion," by S. B. Freeman. At the Engineers' Club, 17, Albert Square, Manchester, at 6.45 p.m.

Royal Statistical Society (Industrial Applications section) :—"Statistics in America—Factory Organisation," by W. Bennett. At the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, at 6 p.m.

Institute of British Foundrymen

NOVEMBER 29.

Falkirk section :—"Mechanised Moulding Practice," by C. Campbell. At the Temperance Café, Lint Riggs, Falkirk, at 7 p.m.

DECEMBER 7.

Lancashire branch :—"The Production of High Quality Steel," by W. H. Salmon. At the College of Technology, Sackville Street, Manchester, at 3 p.m.

Wales and Monmouth branch :—"Steel Castings," by Hardy and Sanders. At the Engineers' Institute, Cardiff, at 6.30 p.m

NEW CATALOGUE

Process Heating by High Frequency Valve Generators. The General Electric Company, Limited, of Magnet House, Kingsway, London, W.C.2, have just issued a 28-page well-illustrated brochure covering high frequency; eddy current and dielectric heating. As the applications are so diverse, the G.E.C. have made arrangements for the research laboratories to be available for piloting through any new ones received. Details of this and other services are clearly set out in the brochure, which is available to our readers on writing to Magnet House.

PUBLICATION RECEIVED

Ni-hard versus Abrasion. Published by the Mond Nickel Company, Limited, Thames House, Millbank, London, S.W.1.

The section of this most interesting and well-illustrated publication is, so far as foundrymen are concerned, "Ni-hard in the Foundry," which starts off Part II. It is an excellent example of suggesting to the doctor that he takes his own medicine. The operation of a foundry, strangely enough, involves the solution of some quite difficult foundry problems. Most of them are associated of a particularly drastic wear due to contact with either sand or abrasives. In this pamphlet many outstanding examples are shown, such as components for sand mills; the grating upon which castings rest whilst being shot-blasted in the rotary table machines; the shot-blast nozzles; and Sandslinger impeller cups. For these applications, plain grey irons simply will not answer the purpose, and resort must be had to more serviceable material. Mechanised plants have now been in service sufficiently long for foundrymen to discover the components which fail due to wear. When this happens they should decide whether or not to make a replacement using these new specially hard irons or not, and, moreover, should advise the equipment makers of their intention so that the whole industry may benefit in the future. Part I of the booklet explains all the underlying principles of the making of these hard irons, whilst the balance of Part II will help the founder to cater for the markets existing for wear-resisting irons in the fields of clay working and gas-making. The brochure is so useful that it is suggested that its value as a work of reference is well worth the effort of writing to the Mond Nickel Company, at the address given above, for a copy; this will be sent free upon mentioning the FOUNDRY TRADE JOURNAL.

RAW MATERIALS GUIDE

A perusal of this 88-page booklet, published for the Board of Trade, by H.M. Stationery Office, shows in no uncertain manner the extent of the controls placed upon industry. So far as the foundry industry is concerned, practically everything except foundry moulding sand is controlled, and the object of this booklet is to tell manufacturers where to stake their claim. Sometimes it is at the Board of Trade, sometimes at the Ministry of Supply, whilst usually it is at some decentralised office. Timber, for instance, requires no fewer than 17 regional offices. For linseed oil—controlled by the Ministry of Food—one applies to the Chrome Ore Control! Manufacturers will appreciate, no doubt, the time when this lengthy booklet will be about as much use as last year's racing calendar.

The guide is obtainable from H.M. Stationery Office, York House, Kingsway, London, W.C.2, price 1s. 6d.

FOUNDRY CO-OPERATIVE ACTIVITIES

We were extremely interested in a book recently received from Paris. It is called "La Corporation des Fondeurs,"* and is written by Mr. Jacques Henri Viez, who indicates that the word "Corporation"—in use in France from the middle of the 17th century—came from the English; but this we doubt, as its use in this country only dates from the 15th century. Moreover, it is obviously Latin in origin. In practice, however, the work of the Corporations strongly resembled that performed by the mediæval London Guilds. It appears that some sort of guilds functioned originally as the colleges of the Romans, and they may not have been the first. The author has much interesting information about these early days, but the story of the organisation of the foundry trades was first disclosed by Etienne Boileau, who was born about 1200, and wrote a book at the instigation of King Louis IX, known as the "Livre des Métiers" (Book of Trades). The author has had a reproduction of the original text, which is in the National Library, setting out the first chapter.

Strong Religious Basis

In common with other guilds, that of the founders had a strongly religious basis; was directly responsible to the king; undertook much charity; guaranteed quality of output; regulated apprenticeship, hours of work, and generally performed all those tasks undertaken by our mediæval guilds. Moreover, from time to time they had to provide men for service with the crown. The patron saint of the founders was originally St. Hubert, who became Bishop of Liège and Maastrich. Originally he was an Ardennes noble who went hunting one Good Friday, when he saw a stag with a fiery cross between the antlers. He became converted, made a pilgrimage to Rome, and was made a Bishop by Pope Sergius. He died in 728 and became the patron saint of huntsmen. Apparently, one saint was insufficient to their needs, as they also placed themselves under the protection of St. Barnabas—patron saint of the artillerymen; St. Gildas; St. Peter of Liens, and St. Eloy (Eloysius?), patron of the metal workers, who gradually became increasingly popular. He was a jeweller before becoming minister to King Dagobert, and Bishop of Noyon.

Though working hours were from sunrise to sunset, there were plenty of holidays in order to celebrate the various saints' days and religious festivals. Apprentices were indentured often at very early ages, but, their number being limited, most could count on becoming master foundrymen. However, there were many who could not, and these valets or companions founded their own lodges. In Paris, in 1682, there were 17,085 masters and 38,000 companions. But from the 14th century, these lodges were started by the building operatives and were divided into three sites, called the Children of Solomon, the Children of Master Jacques, and the Children of Father Soubise. All had as their attributes the compass, square and level. To recognise one another the companions carried a walking stick of special form, ribbons, scarves, ear-rings, and a certain method of greeting and a jumbling of sentences so as to render comprehension impossible to the uninitiated. They had nicknames to make identification by the police more difficult. Apparently this was necessary, as a good deal of bad feeling was evinced between the various sections. Moreover, as some promised on oath not to reveal the secrets of their order when confessing, they were frowned upon by the Church. Like the Corporations, they did much charitable work, and often, in connection with crime, took the law into their own hands. Under the reign of Louis IX, the Orders organised the local lodges by trades, and became so powerful that they could lay down the law to their masters. In 1724 they declared 10 strikes in Paris. The Co-operations were dissolved in 1776, but the "Compagnonages" were left untouched, because they had no legal standing. In 1791, the Le Chapelier Act, however, made their existence contrary to the law, but they still continued and numbered 200,000 at the time of the Restoration, whilst at the 1937 Paris Exhibition there was organised a large-scale competition between the "Compagnons" of the various trades, which was widely commended.

Nomad Founders

To return to the Corporations; it was the custom in mediæval days for the apprentice, on completing his indentures, to present, for the inspection by the Jury of the Corporation, an example of his best work. If it received approval, then, if he could afford the subscription, he could become a master. If not, he remained a "compagnon." The supply of labour was sometimes augmented by the arrival of nomad founders, whose normal work it was to cast bells and cooking pots in the various villages they visited. The manufacture of pig-iron was in the hands of the great monasteries, and later, the nobles. Some of Europe's greatest ironworks found their origin in either monastic or aristocratic enterprise.

The last chapter outlines the reorganisation of the foundry industry under the German occupation. To the foreign reader the impression is gained that some credit must go to the invader. This is not true, as the French foundry industry was very well organised long before the recent war. To those of our readers who are interested in the history of their great industry, and who can read French, we can without reservation recommend this book as being the most thorough and enlightening work so far published.

*Published by La Société de Publications Mécaniques, 15, Rue Bleue, Paris, 9.

THE STEEL, PEECH & TOZER branch of the United Steel Companies, Limited, has converted two of its furnaces at the Templeborough Works from coal to oil burning. Plans are ready for a complete switchover to oil if the coal shortage makes it necessary, and the oil is available.

METALS FREED IN AMERICA

By "ONLOOKER"

It was fairly evident when President Truman did away with price control on nearly all foodstuffs that the whole edifice of ceiling values was in jeopardy, and could not last long. The second week-end in November, following the sweeping Republican victory at the polls, saw the barrier down, and with the exception of rents, rice and sugar, all price control was removed. It is early yet to say whether or not quotations are going to rocket up and stay up, but so far as the non-ferrous metals are concerned the advance has not exceeded 25 per cent. Copper advanced from 12⅛ to 17½ cents, while zinc and lead went to 10½ cents. Tin jumped from 62 to 70 cents. It must, of course, be remembered that hitherto these metals have been subsidised by the U.S. government, and the quotations were therefore quite unrealistic. Somehow or other these systems of artificial price restraint always run into trouble, and there is a firm conviction in the States that production will now respond to the new freedom which allows private enterprise to come into its own again. By a strange coincidence, for it cannot possibly have been planned, an increase in United Kingdom prices of zinc and copper came within a couple of days of the American announcement. Copper was put up by £14 to £98, while zinc increased by a modest "fiver" to £55, coming up to the same level as lead, which has not been altered this time. However, it is definitely undervalued, and there is a general conviction that an advance to beyond £60 will come fairly soon. All scrap quotations have gone up too, in line with the advance in virgin metals, and, strange as it may seem, after the tremendous appreciation of the past year, the general tone is still bullish.

Challenge to Bureaucracy

It cannot be too clearly stressed that a fundamental change has come over the situation, for, whether for good or ill, the American people have revolted against the dark hand of government interference, and in so doing have challenged the bureaucrats. For a time, things may be difficult, but it will be strange if out of the confusion evidence of progress does not emerge. But the repercussions of these events across the Atlantic will be felt in this country; of that there cannot be the slightest doubt. In its most obvious form the effect will be to put up the prices here of commodities we buy from America, or from countries under the influence of the U.S. economic system. There will also, of course, be a decline in the value to us of the dollar credit. But to come to more particular aspects, and to those which apply to metals, it is already apparent that in the very near future we shall see the National Commodity Exchange in New York reopening for trading in metals. Such a step would be quite logical, and indeed necessary, although in pre-war days the U.S. terminal market in metals did not possess the international influence wielded by Whittington Avenue. Nevertheless it is much to be regretted that New York will achieve this flying start, and unfortunately there is no word of metals following in the footsteps of rubber. It is generally understood that the authorities will not consider reopening the metal futures market in this country so long as metals are in short supply. This scarcity exists also in the United States, and it will be interesting to see how prices behave on a free market.

Lead and Copper

Actually the arguments in favour of retaining the present system of bulk purchasing and "decreed" prices in non-ferrous metals have worn rather thin in the face of events during the present year. In lead we have a record high price, and the virtual certainty of a further increase to come, but supplies are hopelessly inadequate and all consumers are rationed. Copper stands within £2 of £100, and can easily go higher. Both these metals are vital to the building programme, and they are, of course, employed also in a great variety of ways in the industries of these islands. That the Government completely misjudged the price trend of many commodities cannot be doubted, and in the result we have suffered from all the drawbacks of the bulk buying system without enjoying the benefits of an ample supply. The *impasse* in lead has been excused on the grounds of world shortage, but it will be instructive to observe our position when in the United States they have achieved a balanced run of supply and demand in this metal. The authorities appear to accept these fantastically high prices for non-ferrous metals in a very philosophical manner, and one presumes they will go on paying the inflated figures demanded by the producers for an indefinite period. One wonders whether the officials concerned ever pause to consider the harm that is being done by the existence of such high values. There was a time, in happier days, when buying for this country was not handled by the Civil Service, when the world prices of the non-ferrous metals were established in London and accepted as authentic by metal interests everywhere. Some day the present spiral of ascending quotations will come to a sudden and disastrous end, and the Government will find itself saddled with huge commitments at peak values. The repercussions of widespread loss of confidence cannot be estimated, but the collapse is likely to be spectacular. As already mentioned, the Americans will shortly be setting in motion again their pre-war commodity market in metals. Let our Government follow the lead and create an opportunity for the trade to protect itself against loss from the fall which is bound to come sooner or later.

THE DEATH IS ANNOUNCED from Johannesburg of Mr. Thomas Nimmo Dewar, at the age of 60. He was born in Scotland and went to South Africa when he was 21 as a colliery surveyor. In 1933 he became managing director of the Union Steel Corporation (of South Africa), Limited. In 1937 he became the second president of the South African branch of the Institute of British Foundrymen.

PERSONAL

MR. R. L. BROWNHILL has been elected a director of Beans Industries, Limited.

MR. L. THOMPSON and MR. G. A. WOODESON have been elected directors of Clarke, Chapman & Company, Limited.

MR. A. P. JESSHOPE, of Jesshope, Limited, engineers, of Longport, a past-president of the Stoke-on-Trent Association of Engineers, is on a visit to Brazil.

MR. E. H. ARMITAGE, chairman of Brown, Bayley's Steel Works, Limited, is on a visit to America in connection with the affairs of one of the subsidiary companies.

MR. OTTO PFAFF, president of the American Foundry Equipment Company, has been elected president of the Foundry Equipment Manufacturers' Association.

MR. ROBERT E. KENNEDY, until recently secretary of the American Foundrymen's Association, has been appointed foundry and patternshop instructor at the Chicago branch of the University of Illinois.

MR. WILLIAM CRESSWELL, who for the last 20 years has been in charge of the screening department of James Wiley & Sons, Limited, manufacturers of nuts and bolts, ironfounders, etc., of Darlaston, is retiring after 50 years' service with the company.

MR. LAWRENCE J. A. HAYWOOD has been appointed chief chemist of Catton & Company, Limited, Yorkshire Steel Foundry, Hunslet, Leeds. He has had a wide experience in modern analytical methods, having been connected with a number of well known Sheffield steelworks during the last few years. More recently he has been with David Brown & Sons (Huddersfield), Limited.

GERMAN PATENT SPECIFICATIONS

More than 70,000 German civil patent specifications, covering wartime developments in German industry and research, have been brought to Britain from the Berlin Patent Office. They are open to inspection at the Patent Office Library, 25, Southampton Buildings, Chancery Lane, London, W.C.2.

The specifications are in German. Name and subject indices are available up to the end of 1942, and quarterly name indices up to September, 1943. Subject searching after 1942, however, may be facilitated by reference to copies of the weekly classification list, "Patentblatt." Photographic copies of any specification and drawing may be obtained at the rate of 6d. per page.

MR. F. M. BURGIS, manager of the marine department of J. Stone & Company, Limited, engineers and founders, Deptford, London, S.E.14, lost his life in the Royal Dutch Air Lines' aircraft crash at Schipol Aerodrome, Amsterdam, recently. He was 51 and had been with the company for over 30 years.

OCTOBER PIG-IRON AND STEEL PRODUCTION

Pig-iron output during October at 623,200 tons was at an annual rate of 8,101,600 tons, and compared with 584,400 tons in October, 1945, when the annual rate was 7,598,200 tons.

Steel production during October, in spite of fuel difficulties and limitation of transport, was 1,017,200 tons, the annual rate being 13,226,000 tons, compared with 972,800 tons (12,648,000 tons) for October, 1945.

The table below shows pig-iron and steel production in October, 1946, with previous figures for comparison:—

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
1946—1st quarter ..	145,500	7,566,000	242,600	12,617,000
2nd ,, ..	150,500	7,827,000	252,100	13,111,000
3rd ,, ..	146,600	7,622,000	230,000	11,953,000
September ..	147,300	7,660,000	238,500	12,402,000
October ..	155,800	8,102,000	254,300	13,226,000
1945—1st quarter ..	134,500	6,992,000	233,200	12,126,000
2nd ,, ..	132,600	6,894,000	227,200	11,814,000
3rd ,, ..	132,600	6,893,000	211,300	10,988,000
September ..	139,300	7,224,000	240,700	12,514,000
October ..	146,100	7,598,000	243,200	12,648,000

IN PARLIAMENT

Surplus Iron and Steel

MR. PALMER asked the Minister of Supply if he would make a statement on the method of disposal of Government surplus steel.

MR. WILMOT replied: All Government surplus stocks of iron and steel, including scrap, are disposed of by Iron & Steel Disposals, Limited, whose capital is wholly owned by the Ministry of Supply and who operate under the direction of the Iron and Steel Board. Prime and re-usable steel is sold direct to consumers, where practicable, or through merchants to the smaller consumers. All surpluses are sold at controlled prices, where these apply, or at the best prices that can be obtained. The Ministry of Supply receives the proceeds of all sales.

Steel Development Plans

MR. WILMOT, Minister of Supply, told the House last week that not one major development plan submitted to the Steel Control Board had been rejected. He admitted, however, that some companies had been asked to defer their proposals or to reconsider the siting. He also revealed that approval had been given to 51 schemes included in the B.I.S.F. plan and to 58 smaller schemes not included in the plan.

BOFORS STEEL AND ARMAMENTS WORKS in Sweden recently celebrated their 300th anniversary.

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HOLWELL
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MACHINE CAST
PIG IRON
THE STANTON IRONWORKS COMPANY
LIMITED
NEAR NOTTINGHAM

NEWS IN BRIEF

RICHARDSONS, WESTGARTH & COMPANY, LIMITED, of Hartlepool, have secured an order for electricity generating plant for the City of Edinburgh, which is to cost about £500,000.

THE TWO NEW INDUSTRIAL ESTATES to be built on the eastern boundary of Glasgow—at Queenslie and Carntyne—will provide employment, it has been estimated, for 5,700 workers.

BABCOCK & WILCOX, LIMITED, Renfrew, have received an order from Birkenhead Town Council for the supply of boiler units and ancillary plant for the new power station at Bromborough, Cheshire.

JOHN HARPER & COMPANY, LIMITED, stove manufacturers and ironfounders of Willenhall, have reopened their London office at Chandos House, Buckingham Gate, S.W.1. (Telephone: Abbey 3184.)

A MINING AND METALLURGICAL COMMITTEE has been appointed by the Royal Anthropological Institute to investigate problems of early metallurgy, as part of its scheme for group studies of the evolution of man.

A. C. WICKMAN, LIMITED, Coventry, announce that, following their appointment as sole world agents for Diaplastics, Limited, Goldhawk Road, London, W.12, a new division of their organisation, the electronics division, is being established, with Mr. F. L. Gladwin, late of Diaplastics, Limited, as manager.

THE HULL FORGE IRON & STEEL COMPANY, LIMITED, Cannon Street, Hull, are entering into voluntary liquidation. It is understood that the premises and ground, which adjoin the works of Rose, Downs & Thompson, Limited, engineers and ironfounders, etc., are being acquired by the latter company.

TWO CONCERNS have been admitted to membership of the British Cast Iron Research Association. They are Guest, Keen, Baldwins Iron & Steel Company, Limited, Port Talbot (representative, Mr. N. Gray or Mr. F. H. Neal), and the State Engineering Works, North Fremantle, Western Australia (representative, Mr. C. L. Henderson).

THE MONTHLY STATISTICAL BULLETIN for October, published by the British Iron and Steel Federation, states that the average number of people engaged in ironfounding during the week ended August 10 was 123,577, against 99,208 a year ago. The production of steel castings in September was 7,200 tons, against 6,600 in August, and 7,800 in September, 1945.

THE COMMISSIONERS OF CUSTOMS AND EXCISE announce that it has come to their notice that in some instances purchase tax has not been charged in respect of vitreous-enamelled iron table tops. The attention of registered traders is accordingly drawn to the fact that the exemption in respect of certain similar articles designed for use in kitchens does not extend to table tops.

THE MONTHLY INFORMATION SHEET for September, just issued by the British Standards Institution, 28, Victoria Street, Westminster, London, S.W.1, lists under new work started, "High-silicon iron castings"; "General grey-iron castings (grades A and C)" (revision of B.S. 321); "High-duty iron castings (grades 1, 2, 3 and 4)" (revision of B.S. 786), and "Sampling and analysis of copper alloys."

ACCORDING TO Mr. C. A. Oakley, Scottish Regional Controller of the Board of Trade, United States, Swedish, Dutch, and Italian firms have obtained permission to set up factories in Scotland for the manufacture of cash registers, tractors, car accessories, light electrical equipment, radios, and typewriters, among other articles. Altogether more than 120 firms, including some from the Midlands and South of England, are opening up factories in Scotland.

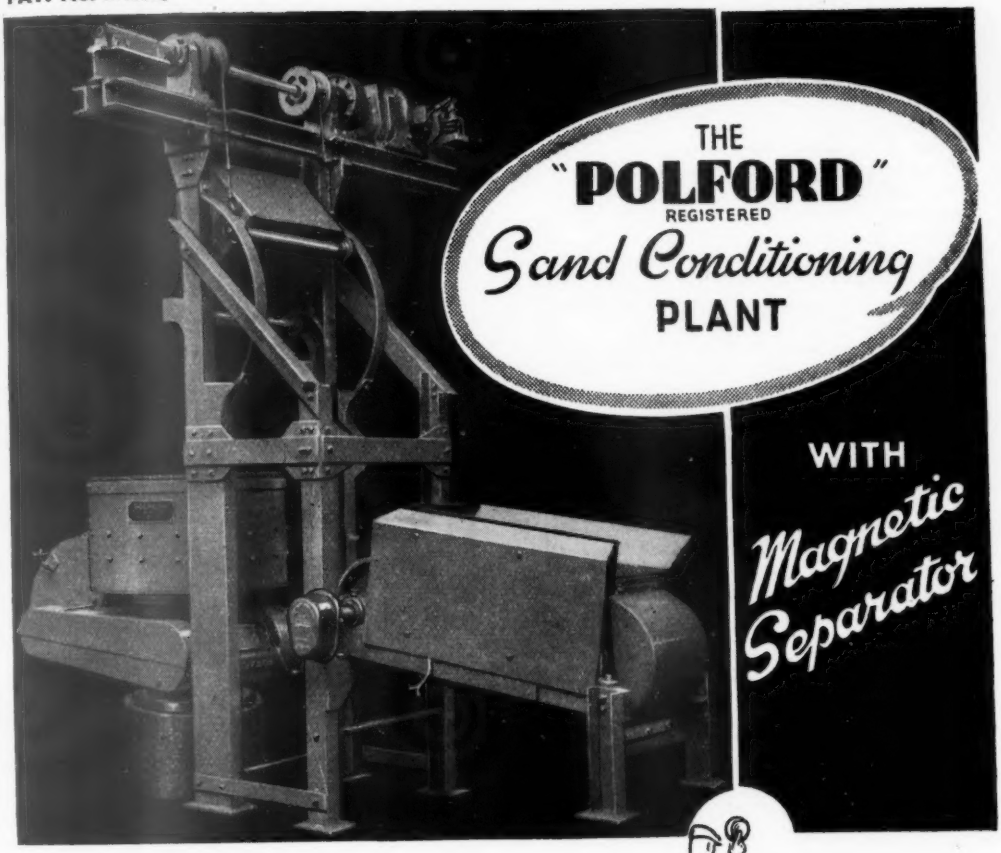
THE BREWERS' SOCIETY is to sponsor an exhibition in London of articles of craftsmanship suitable for the public-house. The object is to encourage the movement towards the enhancing of the social importance of the public-house and to give practical help to the fine crafts after the lean years of war. Ten main headings are tentatively suggested for the exhibits:—Blacksmithing; saddlery; pottery; basket-making; weaving; furniture and woodwork; signs; silversmithing and pewtering; mural painting, and glasswork. The exhibition is planned for the autumn of next year.

RUBERY OWEN & COMPANY, LIMITED, of Darlaston, are proceeding with plans for installing a section of their plant in the Whitegate factory, at Wrexham, which the Ministry of Supply has allocated to the firm. Mr. A. G. B. Owen, chairman of the company, stated last month that, as no houses were being erected in Darlaston for people going into the district from outside, his firm would be forced to look elsewhere for development. The firm intend to transfer by degrees the whole of their sheet-metal manufactures, such as works and office equipment, from Darlaston to Wrexham.

PRIVATE ENTERPRISE, which would have to continue to carry the main burden of British industry, should be given a fair chance in which to operate, said Sir Patrick Hannon, M.P., in his presidential address to the National Union of Manufacturers. The future outlook for industry could only be considered as grave. The acute shortage of raw materials, aggravated often by a rigid and mechanical operation of controls, the lack of labour, low output and the constant threats of reduction or stoppage of production through failure of fuel or power, made the lot of the manufacturer particularly unenviable.

THE FOIRE DE PARIS is to be held from May 10 to 26, 1947. The technical section of the Fair, which, in 1946, surpassed the corresponding section of the Leipzig Fair in 1939, will, in 1947, constitute the most important industrial exhibition throughout the world. Requests for space received to date already absorb the greater part of the total available area, and would-be exhibitors are urged to send in their application forms by the beginning of December, when the actual allocation of space takes place. Application forms, and further particulars, may be obtained from the London representative of the Foire de Paris, Miss E. Lambert, 11-13, Rugby Chambers, 2, Rugby Street, W.C.1.

PAT. No. 570997.



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NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Rahon Steel, 24, Basinghall Street, London, E.C.2—£1,000. N. D. Chopra and V. J. Wigney.

Ferro Metal & Chemical Corporation, 2-5, Old Bond Street, London, W.1—£10,000. J. L. Holt.

Efficiency Engineers (Coventry), 10, Warwick Row, Coventry—£4,000. J. H. Mayne and T. Bell.

Steelwork (Frames), 79, St. Lukes Road, Birmingham, 5—£1,000. G. A. Jones and F. Green.

Postgate Engineering & Construction Company—£6,000. A. E. Postgate, W. J. and B. J. Fretwell.

Truman Engineering Company, 90, Milk Street, Birmingham, 5—£20,000. W. E. and E. M. C. Truman.

G.N. Engineering Company, 127a, University Road, Southampton—£5,000. A. Ganter and W. J. Nelson.

H.M.P. Tool & Engineering Company (1946), 408, Montrose Avenue, Trading Estate, Slough—£20,000.

William Twigg (Matlock), Bakewell Road, Matlock—Steel and iron merchants. £10,000. W. and F. Twigg.

Spear Engineering Company, Titan Works, Warlingham, Surrey—£1,500. W. G. Spear and W. F. Bartlett.

Engineering Products (Coventry)—£5,000. C. S. Melbourne, 321, Holyhead Road, Coventry, subscriber.

Westhurst, Crowborough Hill, Crowborough, Sussex—General engineers. £1,200. S. F. West and J. Hurst.

Harding Castings, 82, Sankey Street, Warrington—£5,000. W. Rosslyn and J. Harding & Company, Limited.

R. W. Sharman, Swan Works, Hanworth, Mdx.—Structural engineers. £10,000. R. W. and K. N. Sharman.

R. Chapman & Company (Ashtead)—Engineers. £1,000. R. Chapman, H. Hopkins, T. Dixon, H. and R. Hughes.

Dodsworth & Sturdy, 67, Micklegate, York—Engineers, etc. £1,000. R. Sturdy, P., W. J. J., and A. S. E. Dodsworth.

John Selley Metal Company, 31, Lancaster Mews, London, W.2—£20,000. J. L. Justice, R. J. Pritchard, and J. Selley.

Shipley Brush Machine Company, 14-15, St. Mary Street, Chepstow, Mon.—£1,000. D. H. Dixon and A. H. Shipley.

J. Watkins & Company, Helena Street, Birmingham—Engineers and machinists. £2,500. F. A., A. I., and A. Watkins.

North Derbyshire Engineering Company, Main Road, Darley Dale, Matlock—£15,000. J. McLean, W. and J. A. Tomlinson.

Bowser International, 2, South Audley Street, Mayfair, London, W.1—Engineers, metallurgists, toolmakers, etc. £50,000. R. H. Damon, F. W. H. Jeans, C. Passman, C. F. Entwistle, W. I. Anderson, and I. R. Cox.

Riches Tools, 4, Belle Vue Parade, Wiseton Road, Wandsworth Common, London, S.W.17—To take over businesses of Dominion Tool & Machinery Company and Dominion Belting Company. £5,000. A. and A. G. Riches.

Production Engineering Research Association of Great Britain—The income and property of the Association, whencesoever derived, are to be applied solely towards the promotion of its objects. British Thomson-Houston, Limited, Rugby, subscribers.

CONTRACTS OPEN

Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.

Cowbridge, December 2—Provision and laying of about 1,000 yds. of 9-in. and 800 yds. of 6-in. dia. stoneware and cast-iron pipes, etc., for the Rural District Council. Thomas & Morgan & Partners, engineers, 23, Gelliwastad Road, Pontypridd. (Fee £5 5s., returnable.)

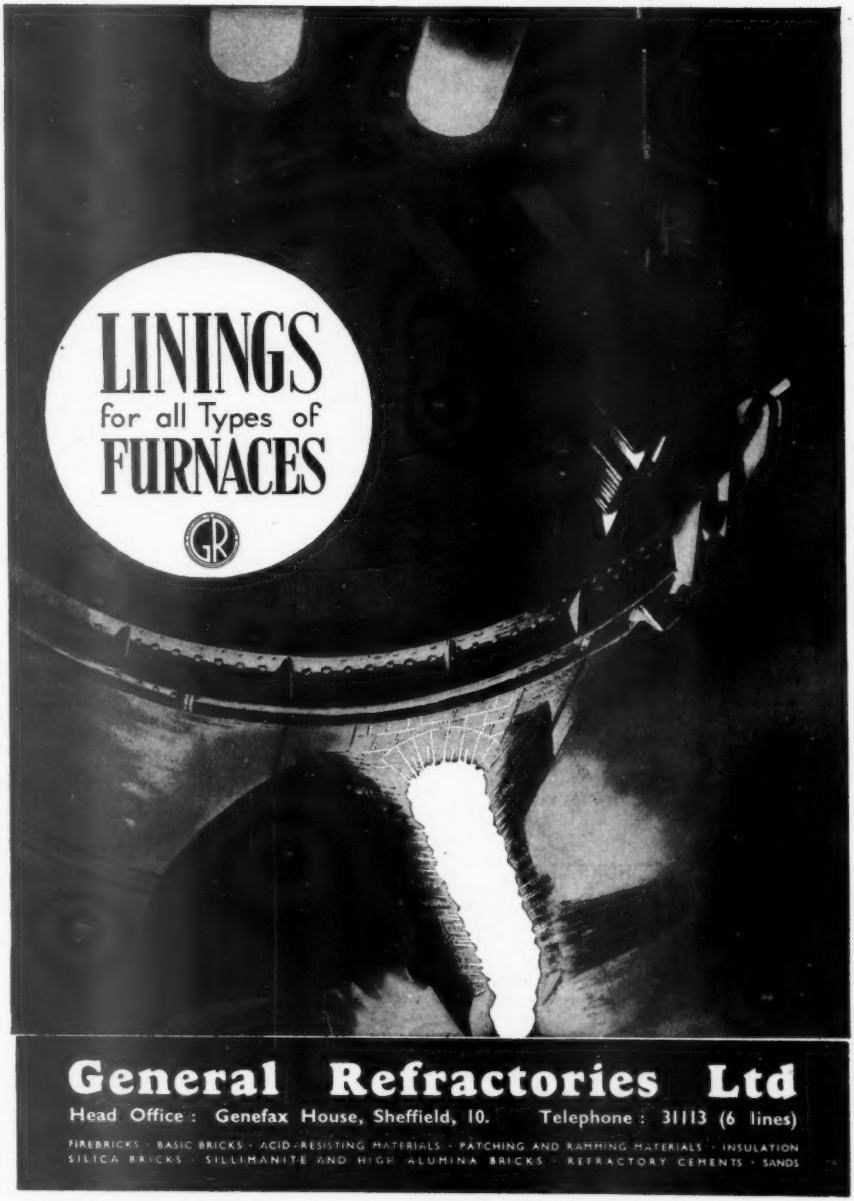
Leyburn, December 4—Supplying and laying 350 yds. of 3-in. spun-iron pipes, together with the construction of a covered service reservoir, etc., for the Rural District Council. Mr. W. K. Rodwell, engineer, 44, Park Cross Street, Leeds. (Fee £1 1s., returnable.)

Manchester, December 4—20,000 yds. of 4-in., 2,000 yds. of 3-in., 1,000 yds. of 2-in. socket and spigot water pipes (equal to B.S.S. class "C" schedule for cast-iron pipes); and 420 sluice valves (4- to 8-in. dia.), for the Corporation Waterworks. The Secretary, Waterworks Offices, Town Hall, Manchester, 2.

North Cornwall, December 2—Construction of approx. 4½ mls. of 9-in. dia. and ¾ ml. of 12-in. dia. spun-iron water main, for the Water Board. Lemon & Blizard, consulting engineers, 24, Lockyer Street, Plymouth. (Fee £3 3s., returnable.)

Wokingham, December 2—Supply and laying of approx. 147 yds. of 6-in. dia. cast (spun) iron and 800 yds. of 6-in. dia. glazed stoneware pipe sewers, together with manholes, etc., for the Rural District Council. Mr. E. A. Hoskins, engineer, Council Offices, Shute End, Wokingham, Berks. (Fee £1 1s., returnable.)

MR. T. H. SKELTON, manager of the electric melting and Tropenas steel converting and foundry heat-treatment departments of Edgar Allen & Company, Limited, has retired for reasons of health. He joined the company in 1901. Mr. Skelton, who is 61 years of age, will be succeeded by MR. W. H. EVERARD, who has been associated with him for 32 years.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Raw Material Markets

IRON AND STEEL

The needs of the general engineering, speciality and jobbing foundries are being met without much difficulty, particularly in respect to pig-iron. There is not, by any means, an unlimited supply of medium- and low-phosphorus pig-iron, but all reasonable requirements are being licensed by the Control; this is the case also with refined and hematite pig-iron, while supplies of ferro-manganese, ferro-silicon and other alloys are adequate. The engineering foundries are fully engaged. Many of those specialising in heavy machine tools have a considerable amount of work ahead. Strong conditions rule in the textile foundries and in the electrical trades. Foundries in the light-castings section are heavily involved, but labour shortage continues to restrict outputs. The supply of high-phosphorus pig-iron is meeting current demands, but there is no margin and extra tonnages will be necessary when the labour situation becomes easier. The flow of scrap is reasonably good, but extra tonnages are wanted in order to make up the shortage in pig-iron, and there is particularly strong pressure for light and medium cast-iron scrap. The engineering foundries, which use also steel scrap, are being reasonably well looked after.

There is a scarcity of steel billets for the re-rollers —both square and flat sizes—the latter being required by the strip rollers, who are heavily committed. Users of square billets have plenty of work in hand, but are being incommoded through meagre supplies of billets wanted for the production of light structural sections, casement bars and the ordinary run of small rounds, squares and flats.

Makers of steel plates, joists, sections and steel sheets are being pressed for deliveries, but delays are inevitable, and all producers are heavily booked. Considerable difficulty is being experienced in getting new orders placed except for delivery well into next year. There is no easing of the position at the rail mills, while the makers of accessories for rails are also fully committed.

NON-FERROUS METALS

The removal of price control in the United States has resulted in the U.S. Government terminating its public purchasing programme on foreign copper. It is understood that the current tariff of 4 cents per lb. on private imports of the metal will continue, which means that American users now requiring copper may have to pay 21½ cents per lb. for metal abroad.

Production of crude copper in the United States in October totalled 72,913 tons, against 69,689 tons in September, according to the American Copper Institute. October refined production was 77,947 tons, compared with 67,803 tons in September.

The Industrial Advisory Committee have requested the American Government to continue domestic tin allocations throughout 1947 in order to assure an equitable distribution of imports, which are not expected to cover the demand.

There is no easing of the world lead shortage, and consumers in this country continue to experience difficulty with regard to supplies. On the other side of the Atlantic, all restrictions on lead imports have been waived, and the Reconstruction Finance Corporation has been told to terminate its purchases of foreign lead except to fulfil existing contracts.

F.B.I. MISSION TO AUSTRIA

The trade mission, under the direction of Mr. C. F. I. Ramsden, overseas director of the Federation of British Industries, has now returned to this country from Austria after spending a week inquiring into the possibilities of co-operation between British and Austrian industry. In an interview, Mr. Ramsden said the members of the mission felt that, taking the long-term view, the Austrian economy had considerable possibilities. Immediate difficulties, however, were great, and the mission had directed its attention to ways and means of getting the ball rolling.

The members of the mission in their individual inquiries had discovered, he said, a number of bottlenecks which were holding up Austria's exports and ability to earn foreign exchange, and it was their hope that they might do something to ease these difficulties. They also felt that there were considerable possibilities of importing from Austria goods badly needed in this country, and propositions to this end would be put to their associations. This country, it was felt, could render Austria real help in the giving of technical advice on modern production technique.

ELECTRON JUBILEE CELEBRATIONS

The 50th anniversary of the discovery of the electron by the British physicist, Sir Joseph Thomson, will occur next year. To mark this jubilee and to demonstrate the tremendous influence such an advance in pure physics may have on the life of the community, the Institute of Physics and the Physical Society are jointly arranging a series of meetings and other functions to take place on September 25 and 26, 1947, in London.

A special exhibition, which will remain open to the public for several weeks, will be held at the Science Museum, South Kensington, and will show the development of modern industrial equipment from its earliest experimental origins.

OBITUARY

MR. JAMES T. POLLARD, of J. Pollard, Limited, Atlas Ironworks, Burnley, Lancs, died recently, aged 70.

MR. ARTHUR GREENWOOD, supplies controller for David Brown & Sons (Huddersfield), Limited, has died at the age of 54.

MR. ALEXANDER NEWLANDS, a director and secretary of Alex. Newlands & Sons, Limited, agricultural engineers, of Linlithgow, has died at the age of 86.